New Entries to IPNI Library as References

Kissinger G. 2012. Corporate social responsibility and supply agreements in the agricultural sector: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS): Working Paper No 14, CCAFS, Denmark.
Reference ID: 22865
Notes: #22865e
Abstract: Corporate social responsibility (CSR) and supply agreements in the agricultural sector have a significant role to play to promote agricultural climate change mitigation and decrease pressure on the earth's land and climate. Private sector engagement can also promote food security and positively affect the livelihoods of smallholder agricultural producers in developing countries. Based on a comprehensive literature survey and 15 interviews with key organizations, companies and financiers or lenders, this report investigates: current private sector climate change mitigation activities in agriculture and food production, highlighting current innovations affecting production and supply chains of key commodities: explores how CSR and supply chain committments can improve their contribution to reductions in agricultural GHG emissions: and surveys the role of governments, finance and investment in promoting sustainability in the agricultural sector.

Walters C. J. and C. S. Holling. 1990. Large-Scale Management Experiments and Learning By Doing. Ecology, 71:2060-2068.
Reference ID: 22866
Notes: #22866e
Abstract: Even unmanaged ecosystems are characterized by combinations of stability and instability and by unexpected shifts in behaviour from both internal and external causes.

Cramb R. and J. F. McCarthy 2016. The Oil Palm Complex, NUS, Singapore.
Reference ID: 22867**Notes: S 8.1.1.5 #22867**
Abstract: The oil palm industry has transformed rural livelihoods and landscapes across wide swathes of Indonesia and Malaysia, generating wealth along with economic, social and environmental controversy.

IPNI. Connections: Providing Leadership and Building Partnerships - Research Projects: Interpretative Summaries - 2015 Crop Year. 1-100. 2016. Georgia USA, IPNI.
Reference ID: 22868
Notes: S 31 #22868e
Abstract: One of the strategic goals of the International Plant Nutrition Institute (IPNI) is to facilitate research on the sustainable use of plant nutrients needed for agriculture to meet future global demand for food, feed, fiber, and fuel. We accomplish this objective through partnerships with colleges, universities, government agencies, and other institutions and organizations around the world where IPNI programs are established.

Grepalma. 2016. 2016 C//PAL Memoria Del Congreso: Sustainable Oil Palm, our commitment. Pages 1-175 Grepalma, Guatemala.
Reference ID: 22869
Notes: S 8.1.1 #22869
(Note first half is in spanish, second half of book is in english)

Andrade F. H. 2016. Los Desafíos de la Agricultura: The Challenges of Agriculture, IPNI, Argentina.
Reference ID: 22870
Notes: S 13 #22870
Abstract: A look at the past can help us understand our creative potential and motivate us to address the problems we face. On the other hand, a prospective look helps us gauge the task to address and identify ways to find solutions.

Li, S., Liu, X., and Ding, W. Estimation of Organic Nutrient Sources and Availability for Land Application. Better Crops With Plant Food 100[3], 4-6. 2016. IPNI.
Reference ID: 22871
Notes: #22871e > S serial #22838e
Abstract: Knowledge of the status and characteristics of organic nutrient resources in China is essential for their effi cient management in agricultural production. Provincial and regional level estimates are provided for the amount of organic wastes, their nutrient supply capacity, as well as their availability to cropland. Great increases in Chinese crop production and livestock farming have in turn produced large amounts of nutrient-laden animal wastes and crop residues. Organic wastes from human activities, and of legume manures are also viewed as valuable organic resources. The recent government policy of "zero growth by 2020" for fertilizer sources is increasing the focus on how all available nutrient sources can be used best. Part of this focus is placed on an increased interest in using organic nutrient sources, like livestock manure, to offset inorganic fertilizer use. The estimation of the nutrient supply capacity and availability from these organic resources is important for understanding nutrient input/output balances in the Chinese agricultural system, and will have a great effect on nutrient management and fertilizer application in China.

Banerjee, H., Dutta, S., Rana, L., Ray, K., Sarkar, S., and Majumdar, K. Fertilization Impacts on Productivity and Profitability of Potato. Better Crops With Plant Food 100[3], 7-9. 2016. IPNI.
Reference ID: 22872
Notes: #22872e > S serial #22838e
Abstract: Economically viable potato production in West Bengal, India relies on balanced fertilizer management to build high yields of quality product, and return a strong economic response. This study supported recommended NPK application rates as a means of increasing the proportion of superior grade potato and optimizing economic returns to farmers. N was the most limiting nutrient, followed by P and then K. Over (150%) or under (50%) application of NPK showed no advantage to potato quality or economic returns. Potato is one of the major staple crops produced throughout the world. The average potato yield in countries such as U.S., Germany, Netherlands, and France range between 38 to 44 t/ha, while in India it is only 23 t/ha (FAOSTAT, 2015). Three states, Uttar Pradesh, West Bengal, and Bihar, jointly contribute about 78% of the total potato production in India. West Bengal is the second largest potato growing state in India, producing 13,400 t from 409,000 ha-an average productivity of 24 t/ha (Govt. of West Bengal, 2012).

Kihara, J., Njoroge, S., and Zingore, S. Analysis of Crop Nutrient Response Patterns to Guide Site-Specific Fertilizer Recommendations. Better Crops With Plant Food 100[3], 10-12. 2016. IPNI.
Reference ID: 22873
Notes: #22873e > S serial #22838e
Abstract: Large field-to-field variability in maize response to fertilizer additions indicates considerable diff erences in sub-Saharan African soil conditions. Cluster analysis categorized results from on-farm trials to determine the variability in soils and crop productivity. The technique effectively separated responsive from non-responsive fields, and further helps to identify the limiting factors to productivity.
Poor productivity of food crops due to low soil nutrient levels is a major contributor to food insecurity in subSaharan Africa (SSA) (Shapouri et al., 2010). Current investments to help farmers increase fertilizer use are not often supported by appropriate fertilizer recommendations (Giller et al., 2011), resulting in poor fertilizer use efficiency and low economic returns to investment in fertilizer (Nziguheba et al., 2009). Information that can help to target the right fertilizer source and application rates for specific crops and locations, is crucial for sustainable crop production intensifi cation in smallholder farming systems.

Sharpley, A., Daniels, M., Berry, L., Hallmark, C., and Riley, L. Proactive Stakeholder Program Measures On-farm Effectiveness of Conservation Practices that Reduce Fertilizer and Manure Nutrient Loss. Better Crops With Plant Food 100[3], 13-15. 2016. IPNI.
Reference ID: 22874
Notes: #22874e > S serial #22838e
Abstract: Livestock and crop agriculture are often cited as major contributors of nonpoint source (diff use) losses of soil and nutrients to water resources. Runoff losses of soil and nutrients from representative farm fi elds are being investigated under different conservation and nutrient management practices in Arkansas, through a collaborative farmer-stakeholder partnership program. Results to date indicate that Arkansas farmers are helping to keep sediment and nutrient losses lower than what many had previously perceived. The Arkansas Discovery Farm (ADF) Program is a statewide collaborative effort to monitor and demonstrate the on-farm effectiveness of conservation practices (CPs) to minimize nutrient runoff (Sharpley et al., 2015). A similar effort is in various stages of operation in Minnesota, South Dakota, and Wisconsin and all are charged to some extent to develop nutrient loss reduction strategies to mitigate local and regional water quality concerns.

Bee, K. C., Davis, P., Black, T., and Thomason, W. In-Season Decision Support Tools for Estimating Sidedress Nitrogen Rates for Corn. Better Crops With Plant Food 100[3], 16-18. 2016. IPNI.
Reference ID: 22875
Notes: #22875e > S serial #22838e
Abstract: Four different in-season N rate decision support tools were equally effective in generating yield, but differences in N use efficiency were detected. The Virginia Corn Algorithm (VCA) approach appeared best able to prescribe best fit, sidedress N rates under varying preplant N supply options. The ability to provide a seasonally adjusted sidedress N rate reduces the emphasis on preplant N rates to allow a better match with crop demand and improved N use efficiency.

Nitrogen is frequently the most limiting factor in cereal crop production and 115 million metric t of nitrogenous fertilizers are applied annually to support crop production (FAO, 2015). Fertilizer nitrogen use efficiency (NUE), is estimated to be 33% and 42% for global cereal and U.S. corn production, respectively (Raun and Johnson,1999). Improving N fertilizer management necessitates the application of the right amount of N using the right source at the right timing, in the right place (Bruulsema et al., 2009). While determining the best approach for any of these factors is complicated, rate is perhaps the most difficult due to the complexities of the N cycle.

Stewart, M. and Morgan, G. D. Impact of Soil Applied Potassium on Cotton Yield and Profitability. Better Crops With Plant Food 100[3], 19-22. 2016. IPNI.
Reference ID: 22876
Notes: #22876e > S serial #22838e
Abstract: The frequency and severity of K deficiency symptoms is increasing on some highly productive cotton-producing soils in Texas. The effects of K fertilizer rate and placement were investigated to determine their impact on cotton yield, fiber quality parameters, and profitability. Where response to K was observed, band outperformed broadcast applications, with significant improvement in yield and return on investment. Texas produces more cotton than any other state in the U.S. Over the three most recent years of production (2013-15), Texas has produced 40% of total U.S. cotton (USDA-NASS, 2016). Most of this production comes from the High Plains of Texas-the largest contiguous cotton-producing region in the world. But other areas within the state such as the Trans-Pecos, Rolling Plains, Rio Grande Valley, Blacklands, and Coastal Prairie regions also produce significant amounts of cotton (Figure 1). Table 1 illustrates the economic importance of Texas cotton production relative to other common crops.

ISP. The Planter Vol 92 No 1081 April 2016. [92], 197-270. 2016. Kuala Lumpur, ISP.
Reference ID: 22877
Notes: S serial #22877
In this issue:
Technical: The Evaluation of Solid Substrate Formulation of *Metarhizium anisopliae* var. *major* (M-SS) against *Oryctes rhinoceros* L. in Young Oil Palm Plantations **#22878**
Reproduced: The Risk Management Process **#22879**

Zainal Abidin C. M. R., N. H. Hamid, M. R. Mamat, and N. Mohd Salehan. 2016. The Evaluation of Solid Substrate Formulation of *Metarhizium anisopliae* var. *major* (M-SS) against *Oryctes rhinoceros* L. in Young Oil Palm Plantations. The Planter, 91:205-224.
Reference ID: 22878
Notes: #22878 > S serial #22877
Abstract: The pathogeneticity of Metarhizium anisopliae var.major - solid substrate (M-SS) was evaluated against Oryctes rhinoceros in a greenhouse and large-scale field study of new oil palm replanting areas. The M-SS was prepared by fermenting 500g maize bran with 7ml M.anisopliae mycelia liquid for 30 days to achieve M-SS viability of 91.45 per cent. The greenhouse study indicated that application of M-SS at 3.74g per sq.m killed 92.17 per cent of the first, second and third instars larvae at six weeks after application (WAA) and is equally effective as commercially prepared Metarhizium forumlated in powder form.

Tee S. H. and S. K. K. Chua. 2016. The Risk Management Process. The Planter, 92:225-245.
Reference ID: 22879
Notes: #22879 > S serial #22877
Abstract: Commodity trading under current global structures must meet more challenges in the form of production costs, competition from substitutes, technological and yield differences, and comply with social and environmental demands. Malaysian plantations businesses and operators have to undertake such challenges to remain profitable. Quality assurance practices have to be complemented by a risk assurance system in order to protect margins, company's assets and shareholder's investment.

ISP. The Planter Vol 92 No 1082 May 2016. [92], 279-346. 2016. Kuala Lumpur, ISP.
Reference ID: 22880
Notes: S serial #22880
In this issue:
Technical: A Comparison of Three Field Layout Systems for Mechanisation during Early Phase of Rubber Cultivation **#22881**
Reproduced: Challenges Facing Plantation Management **#12741**

Yew F. K., T. M. Tuan Muda, D. Muthiah, and M. Z. Md Delin. 2016. A Comparison of Three Field Layout Systems for Mechanisation during Early Phase of Rubber Cultivation. The Planter, 92:287-306.
Reference ID: 22881
Notes: #22881 > S serial #22880
Abstract: Mechanisation is needed to alleviate the shortage of labour in plantation agriculture. The first step towards a successful implementation of many mechanised operations in plantation agriculture is the need to have a field layout system which will facilitate bringing mechanised operations into the interior of the field. In fact, the implementation of such a field layout system must be done as early as possible after land clearing. This will allow more field operation to be mechanised. The design of such a layout system for rubber growing areas poses challenges since the crop is often planted on sloping to hilly terrain.

ITC. Product Carbon Footprinting Standards in the Agri-Food Sector (Technical Paper). 1-61. 2012. Geneva, International Trade Centre.
Reference ID: 22882
Notes: #22882e
Abstract: This paper aims to guide exporters of agricultural products through the process of product carbon footprinting so as to make it easier for them to understand the processes involved, improve their environmental performance and ultimately to reduce the costs for their business. This paper presents a typology of PCF schemes and initiatives including relevant examples, the different steps involved in calculating a PCF, the main challenges in relation to methodology, data and uncertainty, issues particularly relevant to developing countries, and an overview of potential mitigation measures.

Carpenter S. R. 1996. Microcosm Experiments have Limited Relevance for Community and Ecosystem Ecology. Ecology, 77:677-680.
Reference ID: 22883
Notes: #22883e

Abstract: Advantages of microcosm experiments are extolled by contributions to this Special Feature and other recent publications (Threlkeld 1993, Kareiva 1994). Some of my own work has benefitted from the speed, replicability, statistical power, and mechanistic insights attainable using microcosms, so I am not entirely opposed to the approach. Microcosms have become an important tool for some ecologists. However, microcosm experiments also have serious limitations. Without context of appropriately scaled field studies, microcosm experiments become irrelevant and diversionary.

Cock J., S. P. Kam, S. Cook, C. Donough, Y. L. Lim, A. Jines-Leon, C. H. Lim, S. Primananda, B. T. Yen, S. N. Mohanaraj, Y. M. S. Samosir, and T. Oberthür. 2016. Learning from commercial crop performance: Oil palm yield response to management under well-defined growing conditions. Agricultural Systems, 149:99-111.
Reference ID: 22884
Notes: #22884e
Abstract: Farmers learn from their own experiences. However, they are rarely sure if an exceptionally good or bad outcome is due to chance effects or whether it is due to a given combination of management practices and environmental conditions. We surmised that, if each harvest event is adequately characterized and a large number of these events are analyzed together, it should be possible to associate crop response to management within a particular set of growth conditions. We tested this hypothesis using the perennial crop, oil palm.

Ab Rahman A. K., R. Abdullah, F. Mohd Shariff, and M. A. Simeh. 2008. The Malaysian Palm Oil Supply Chain: The Role of the Independent Smallholders. Oil Palm Industry Economic Journal, 8:17-27.
Reference ID: 22885
Notes: #22885e
Abstract: The Malaysian palm oil industry is made up of interrelated sectors that produce various palm products for their end-users. To ensure an efficient supply chain, all sectors should operate efficiently; this includes the independent smallholders. An efficient production system by the smallholders is deemed necessary in producing quality fresh fruit bunches (FFB) which can then produce quality palm oil for meeting the rising global demand. Inefficiencies can affect the whole supply chain. This article investigates the efficiency level of this sector and the structural changes that it has undergone. It was found that there is plenty of room for improvement among independent smallholders to increase their FFB yield and income so that their future can be sustained.

Whittaker C., M. C. McManus, and P. Smith. 2013. A Comparison of Carbon Accounting Tools for Arable Crops in the United Kingdom. Environmental Modelling & Software, 46:228-239.
Reference ID: 22886
Notes: #22886e
Abstract: In light of concerns over climate change and the need for national inventories for greenhouse gas reporting, there has been a recent increase in interest in the 'carbon foot printing' of products. A number of LCA-based carbon reporting tools have been developed in both the agricultural and renewable energy sectors, both of which follow calculation methodologies to account for GHG emissions from arable cropping. A review was performed to compare 11 existing greenhouse gas (GHG) accounting tools produced in order to calculate emissions from arable crops, either for food or bioenergy production in the UK, and a multi-criteria-analysis was performed to test

their relative strengths and weaknesses. Tools designed for farm-based accounting achieved a higher 'user-friendliness' score, however bioenergy-based tools performed better in the overall level of information provided in the results, transparency and the comprehensiveness of emission sources included in the calculations. A model dataset for UK feed wheat was used to test the GHG emissions calculated by each tool. The results showed large differences, mainly due to how greenhouse gas emissions from fertiliser manufacture and application are accounted for. Overall, the Cool Farm Tool (Hillier et al., 2011) was identified as the highest ranking tool that is currently available in the public domain. The differences in the results between the tools appear to be due to the goal and scope, the system boundaries and underlying emission factor data.

IPNI. Plant Nutrition Today - Fall 2015. 1-6. 2015. USA, IPNI.
Reference ID: 22887
Notes: #22887e
In this issue:
Fall 2015 No 1 - Evaluating Impacts of 4R Nutrient Stewardship
Fall 2015 No 2 - Strategies to Improve Distribution of Less Soil Mobile Plant Nutrients
Fall 2015 No 3 - Years of Soils: Soil Degradation Destroys Productivity
Fall 2015 No 4 - Plug into a Research Network
Fall 2015 No 5 - The Value of Variable Rate Technology (VRT)
Fall 2015 No 6 - Potash Origin and Sources

Wessel M. and P. M. F. Quist-Wessel. 2015. Cocoa production in West Africa, a review and analysis of recent developments. NJAS - Wageningen Journal of Life Sciences, 2015:1-7.
Reference ID: 22888
Notes: H 8.1.4 #22888e
Abstract: This paper reviews the present condition of cocoa growing in West Africa where some six million ha are planted with cocoa which provide about 70 percent of the total world production. Côte d'Ivoire and Ghana are the largest producers, followed by Nigeria and Cameroon. In the beginning of the 21st century the cocoa production increased from about 2,000,000 tons to about 3,000,000 tons in 2010 and subsequent years. While in this period expansion of the cocoa area (at the expense of forest land) contributed to increased production, nowadays more cocoa has to come from higher yield per ha which is very low at present. This paper highlights at first cocoa growing in each of the cocoa producing countries and then deals with the common constraints and options to higher yields, especially those in Côte d'Ivoire and Ghana. The major causes of low yield are a high incidence of pests and diseases, the old age of cocoa farms and lack of soil nutrients.
Concerns about declining output due to aging and diseased trees have urged the government of Côte d'Ivoire and Ghana to launch large rehabilitation and replanting schemes which provide farmers with improved planting materials, plant protection chemicals and fertilizers. As owners of small farms do not earn enough income from their cocoa to purchase external inputs, the traditional mixed planting of cocoa and forest and fruit trees and some oil palms is discussed as an alternative to a high input approach. This low input low output system is sustainable but not the way forward to higher yields.
It is thought that in the short run higher cocoa prices and improved management including pest and disease control and to a certain extent fertilizer use offer scope for a larger cocoa output. In the more distant future the predicted climatic change and increased land use for food production will reduce the size of the cocoa area and affect

the leading position of West Africa on the world cocoa market. This review shows that at present the conditions for sustainable production are not met and concludes that important structural changes in the cocoa sector are needed to reach this goal. These changes concern the economic viability of cocoa on small farms, extensive land use and the ecological impact of the current cocoa growing practice. The implementation of these changes requires area specific programs with as their common goal increased economic and environmentally sustainable cocoa production on less land.

C & CI and C. C&CI: Coffee and Cocoa International September 2011. Coffee & Cocoa International 43[4], 1-50. 2016.
Reference ID: 22889
Notes: S serial #22889

IFC 2016. Building a roadmap to sustainability in agro-community production.
Reference ID: 22890
Notes: #22890e
Abstract: Agriculture has performed well over the last 50 years, not only keeping pace with rapid population growth, but also delivering food at progressively lower prices. Unfortunately this growth has led to overuse of natural resources and the release of greenhouse gases and other pollutants. In social terms, moreover, many agricultural producers continue to live at or below the poverty line, and agricultural workers may be subject to unacceptable working conditions.
Achieving sustainability in the production of agricultural commodities is necessary to ensure food security, a healthy natural resource base and human wellbeing. To meet the challenge of these sustainability issues, voluntary sustainability standards (VSS) have been established. However, it appears that VSS initiatives have now encountered limits in terms of uptake and impact. The central question of this research project is: how can these efforts be scaled up?
IFC has been challenged by its key stakeholders to play a leadership role in promoting the adoption of these standards in the financial sector. Before stepping up to such a task, IFC wanted to understand whether voluntary standards systems (VSS) are creating the expected and desirable environmental and social benefits and impacts. Ultimately, IFC and its partners require guidance to develop a roadmap for sustainability, which defines strategies to promote the largescale implementation of sustainable agro-commodity production through means of intensification in a sustainable (social and environmental benign) and inclusive (of smallholders) way.
This report
- Phase I of the project - presents initial findings and proposes a roadmap towards greater sustainability impacts within various agro-commodity sectors. In Phase II, this roadmap will be developed further and concrete applications will be explored through a series of dialogues that aim to re-shape sectors and structure innovative ways of market cooperation. These steps can be initiated after delivery of Phase II.

Mestanza S. S. and J. C. Lainez. 1970. The Correction of Boron Deficiency in Cacao in Ecuador. Tropical Agriculture (Trinidad), 47:57-61.
Reference ID: 22891
Notes: #22891e
Abstract: In several newly established plantations in cacao in the Quevedo zone of the Los Rios Province of Ecuador, leaf symmptoms are found which are characteristic of boron deficiency. Yields are low and the situation is complicated by high losses of young trees from attack by Ceratocystis fimbriata.

ICO. Report of the Working Group on the Review of the Study on the Global Cocoa Sustainability Fund. 1-84. 2016.
Reference ID: 22892
Notes: #22892e
(Consultative Board on the World Cocoa Economy, Thirty-third meeting, Holiday Inn Hotel, Wembley, 26th Sept 2016)
Abstract: This document reports on the comments and suggestions made by Members of the Working Group on a Global Cocoa Sustainability Fund, established by the Consultative Board on the World Cocoa Economy at its 32nd meeting in May 2016. The objective was to review the full study on the Feasibility Study for a Global Cocoa Sustainability Fund which was conducted for the ICCO by the Sudwind-Institute and co-financed by the German Initiative on Sustainable Cocoa (GISCO). It contains a summary of discussions conducted by members of the Working Group in July 2016 through email exhanges.
Based onthe inputs provided by the Working Group, the Consultative Board is invited to make a recommendation to the International Cocoa Council for consideration at its 94th regular session in September 2016 on the way forward with regard to the establishment of a Cocoa Sustainability Fund.

WCR 2016. Coffee Varieties of Mesoamerica and the Caribbean.
Reference ID: 22893
Notes: #22893e
Abstract: Arabica coffee varieties are all members of the same species, but they have different traits. Arabica coffee first arrived in Mesoamerica in the mid-1700s. Historically, most coffees in the region descend from just two varieties: Typica and Bourbon. In the mid-20th century, breeders began introducing varieties that possessed genetics from the C. canephora (Robusta) species, which made them resistant to coffee leaf rust. More recently, genetically diverse Ethiopian varieties and F1 hybrids have been introduced bringing new possibilities for coffee growers. Coffee Varieties of Mesoamerica and the Carribean presents information for coffee producers and anyone working with coffee plants about how different varieties can be expected to perform under ideal conditions. The intention of this catalog is that those working with coffee should be able to make informed decisions about which variety will work best for their situation and needs.
Because the life of a coffee tree is 20-30 years, the decision producers make about which variety to plant will have consequences until the next generation. Coffee producers who make good planting decisions are at much less risk from disease or pests. Choosing the right type of coffee also has consequences for quality in the cup. Planting coffee that is well-adapted to the local environment is one critical factor in ensuring the highest possible quality.

IPNI. Plant Nutrition Today - Spring 2015. 1-7. 2015. USA, IPNI.
Reference ID: 22894
Notes: #22894e
In this issue:
Spring 2015 No 1-Human Health Depends on Soil Fertility
Spring 2015 No 2-Using Cover Crops to Improve the Success of Cropping Systems
Spring 2015 No 3-International Year of Soils: Modifying Soil to Improve Crop Productivity
Spring 2015 No 4-When 1+1=3
Spring 2015 No 5-Sensor-Based Nitrogen Fertilization for Cotton

Spring 2015 No 6-Pre-plant Soil Nitrate - Meaningful or Malarkey?
Spring 2015 No 7-Cotton Nutrition and Fertilization

IPNI. Plant Nutrition Today - Winter 2015. 1-7. 2015. USA, IPNI.
Reference ID: 22895
Notes: #22895e
In this issue:
Winter 2015/16 No 1-Fitting the 4Rs into Nutrient Cycle Stewardship
Winter 2015/16 No 2-Customizing Your Fertilizer Applications in Relation to Weather
Winter 2015/16 No 3-Year of Soils:4R Nutrient Stewardship and Soil Management
Winter 2015/16 No 4-4R Fund Supports the Next Generation of Crop Nutrition Research
Winter 2015/16 No 5-Getting more out of 4R Performance Indicators with Precision Agriculture
Winter 2015/16 No 6-Nickel is a Plant Nutrient...Really?
Winter 2015/16 No 7-Fantasy Fertility - Not Sustainable

IPNI. Plant Nutrition Today - Spring 2016. 1-7. 2016. USA, IPNI.
Reference ID: 22896
Notes: #22896e
In this issue:
Spring 2016 No 1-Phosphorus and Photosynthesis
Spring 2016 No 2-Commercial Fertilizers and Certified Organic Fertilizers - Are They That Different?
Spring 2016 No 3-Need a Micronutrient Review?
Spring 2016 No 4-Nutrient Considerations for Low Corn Prices
Spring 2016 No 5-Precision People
Spring 2016 No 6-Manganese in Crop Nutrition
Spring 2016 No 7-Suites of 4R Nitrogen Practices for Better Crops and Environmental Protection

IPNI. Plant Nutrition Today - Fall 2016 No 1: Phosphorus and Soil Health. 1-2. 2016. USA, IPNI.
Reference ID: 22897
Notes: #22897e
Abstract: Soil Health has elicited interest from many. The idea of looking at the soil as a living system with physical, chemical, and biological aspects of its functioning engages imaginations of crop producers and consumers alike. Policymakers and extension educators have particularly linked onto soil health as a key attribute in reduction strategies for phosphorus (P) loss. Are their expectations warranted?

IPNI. Plant Nutrition Today - Fall 2016 No 2: Nitrogen Fertilizer Management: Precision to Decision. 1-2. 2016. USA, IPNI.
Reference ID: 22898
Notes: #22898e
Abstract: Production agriculture is firmly entrenched in a digital revolution. Critical information that can help guide on-farm decisions is more easily accessible, more rapidly available, and more inexpensive than ever before. The downside of all this information is that advisors and growers are becoming inundated with data to the point that it sometimes inhibits the decision-making process rather than enhancing it. Kansas State University ag economist, Terry Griffin, likes to say "data are useless."

THis statement often draws immediate argument from those providing the data, but is clarified when explained that data-in and of themselves-actually do have little value until they are analyzed and applied in an intelligent manner to improve some practice.

IPNI. Plant Nutrition Today - Fall No 3: Does Fertilizer Nitrogen Help Or Harm Soil Biology? 1-2. 2016. USA, IPNI.
Reference ID: 22899
Notes: #22899e
Abstract: Many farmers and their advisers have learned that reduced tillage (including no-till) and conitnuous soil vegetative cover favor the presence and activity of beneficial fungi termed arbuscular mycorrhizal fungi (AMF). These fungi are well recognized for their symbioses with the roots of corn, wheat, soybean and many other major crops-including cover crops-and their ability to enhance root acquisition and uptake of phosphorus, water, and micronutrients.

IPNI. Plant Nutrition Today - Fall 2016 No 4: Fertilizing for Dual-Purpose Wheat. 1-2. 2016. USA, IPNI.
Reference ID: 22900
Notes: #22900e
Abstract: Producing winter wheat for both grazing and grain-or dual purposes-is common in the southern Great Plains, with acreage tending to decline moving northwards. The dual-purpose system works well in states such as Texas and Oklahoma because temperatures favor wheat growth well into the winter months, there is relatively little snow and ice cover, and most producers have experience with livestocks.

IPNI. Plant Nutrition Today - Fall 2016 no 5: Why All The Fuss About Sulfur Fertilizers? 1-2. 2016. USA, IPNI.
Reference ID: 22901
Notes: #22901e
Abstract: A few decades ago there was very little mention of adding sulfur (S) as a fertilizer. In the late 1970s, I can remember my soil fertility professor at the University of Alberta being credited with documenting a S deficient field soil in Southern Alberta-an area where S deficiencies were not thought to be possible. It wasnt that crops back then didn't need or use S, but just that most soils supplied adequate amounts to meet crop demands.

Lahav E. and D. Kalmar. 1988. Response of Banana to Drip Irrigation, Water Amounts and Fertilization Regimes. Communications in Soil Science and Plant Analysis, 19:25-46.
Reference ID: 22902
Notes: #22902e
Abstract: The price of water in Israel, its availability, and the other options for its use, made it necessary to examine the amount of water actually required by banana. (Musa cavendishii Lamb.) Water amounts were fixed according to the evaporation factor from a Class A pan. The factor changed throughout the irrigation season. At the peak of the season, the rate of water application corresponded to f=0. 8, 1.0, 1.2 and 1.4. An additional treatment, with a constant factor of evaporation (f=1.0), was applied. Two fertilizer regimes were also tested: a fixed dose of fertilizer applied once a week, and a constant concentration of fertilizer injected into the irrigation water throughout the irrigation season. The water applied amounted to 8450-14470 m^3/ha/year. The

increased water amount led to an increase in sucker height, earlier flowering, more bunches, and a small increase in average bunch weight. Maximum effects were found in suckers irrigated at f=1.4. The suckers irrigated at f=0.8 were inferior to all others. The weekly fertilizer application had a slight but nonsignificant advantage over the continuous fertilization regime.

Sajith K. P., S. Uma, M. S. Saraswathi, S. Backiyarani, and P. Durai. 2014. Macropropagation of banana - Effect of bio-fertilizers and plant hormones. Indian Journal of Horticulture, 71:299-305.
Reference ID: 22903
Notes: #22903e
Abstract: Stimulation of lateral bud development and plantlet production is generally accomplished through decapitation methods in banana. Attempts were made in the present study to enhance the efficacy of decortication in elite cv. Bangladesh Malbhog using additives like bio-fertilizers and plant growth hormones. This trial was carried out with suckers weighing 1.0-1.5 kg and sawdust as substrate. All treatments tested, showed good response in terms of plantlet production and enhanced bud proliferation, growth and better root profiles compared to control. Treatment T-11 (Bacillus subtilis + BAP) produced the maximum number of primary buds (3.77) followed by T-3 (Trichoderma viride) and T-6 (AMF + T. viride) with 3.50 and 3.47 buds respectively as compared to control (2.03 buds). Secondary bud production was also observed higher in treatment T-11 with 5.70 buds per sucker followed by treatments T-3 and T-6 with 4.70 and 4.57, respectively. As far as tertiary bud production was compared, T11 gave the highest of 7.33 buds followed by T-3 (7.20) and T-6 (6.70) with a least of 3.33 buds in control. Addition of IBA and Azospirillum (T-7) were observed to have good response in terms of root formation and enhanced bud regeneration (5.77 tertiary buds). Total number of buds produced was also observed highest in T-11(16.80) followed by T-3 (15.40) and T-6 (14.73) suggesting that treatment combinations, B. subtilis + BAP and AMF + T. viride, were effective for macropropagation of cv. Bangladesh Malbhog.

Baset MIa M. A., Z. H. Shamsuddin, Z. Wahab, and M. Marziah. 2010. Rhizobacteria as bioenhancer and biofertilizer for growth and yield of banana (Musa spp. cv. 'Berangan'). Scientia Horticulturae, 126:80-87.
Reference ID: 22904
Notes: #22904e
Abstract: Banana, an important fruit crop, requires high amounts of fertilizers for commercial cultivation, which is costly and can be hazardous to the environment when used excessively. Inoculations of plant growth promoting rhizobacteria (PGPR) have been shown to produce beneficial effects through growth stimulation in legumes and cereals, and an attempt has been made to use rhizobacteria in bananas. Three experiments were conducted to observe the effects of plant growth promoting rhizobacteria (PGPR) inoculation on root stimulation and colonization, nutrient absorption, growth and yield of bananas (Musa spp. cv. 'Berangan', AA type). The results showed that inoculation together with 33% N improved the bioenhancing activity by increasing root and shoot growth, and photosynthetic rate. The PGPR inoculation with 33% N-fertilizer also increased the Ca uptake capacity resulting in higher Ca concentration in root, corm and pulp but increased the Mg concentration in the root only. In addition, the total accumulation of nutrients was heavily influenced by PGPR inoculation due to enhanced root proliferation. The PGPR inoculation greatly increased the bunch yield (35-51%). The strains Sp7 and UPMB10 were evaluated for

their N(2) fixing capacities in association with banana roots by (15)N isotopic dilution technique and acetylene reduction assay (ARA). The results conclusively showed that roots of PGPR-inoculated plants fixed N(2) and produced higher ARA values and inoculated plants together with the least N-fertilizer supply showed the highest amount of nitrogen derived from atmosphere (Ndfa). The findings from the above studies demonstrated that PGPR strains (Sp7 and UPMB 10) inoculation with minimal N-fertilizer supply are effective as a bioenhancer for increasing plant growth, nutrient uptake and yield of bananas.

Pattison A. B., C. L. Wright, T. L. Kukulies, and A. B. Molina. 2014. Ground cover management alters development of Fusarium wilt symptoms in Ducasse bananas. Australian Plant Pathology, 43:465-476.
Reference ID: 22905
Notes: #22905e
Abstract: Many banana producing regions around the world experience climate variability as a result of seasonal rainfall and temperature conditions, which result in sub-optimal conditions for banana production. This can create periods of plant stress which impact on plant growth, development and yields. Furthermore, diseases such as Fusarium wilt caused by Fusarium oxysporum f. sp. cubense, can become more predominant following periods of environmental stress, particularly for many culturally significant cultivars such as Ducasse (synonym Pisang Awak) (Musa ABB). The aim of this experiment was to determine if expression of symptoms of Fusarium wilt of bananas in a susceptible cultivar could be explained by environmental conditions, and if soil management could reduce the impact of the disease and increase production. An experiment was established in an abandoned commercial field of Ducasse bananas with a high incidence of Fusarium wilt. Vegetated ground cover was maintained around the base of banana plants and compared with plants grown in bare soil for changes in growth, production and disease symptoms. Expression of Fusarium wilt was found to be a function of water stress potential and the heat unit requirement for bananas. The inclusion of vegetative ground cover around the base of the banana plants significantly reduced the severity and incidence of Fusarium wilt by 20 % and altered the periods of symptom development. The growth of bananas and development of the bunch followed the accumulated heat units, with a greater number of bunched plants evident during warmer periods of the year. The weight of bunches harvested in a second crop cycle was increased when banana plants were grown in areas with vegetative ground cover, with fewer losses of plants due to Fusarium wilt.

Mosquera-Losada M. R., A. Gonzalez-Rodriguez, and A. R. Rodriguez. 2004. Fertilization with nitrogen and potassium on pastures in temperate areas. Journal of Range Management, 57:280-290.
Reference ID: 22906
Notes: #22906e
Abstract: Fertilizer application enable producers to influence pasture production. The effect of N fertilization on grass production and leguminous plant content of pasture and strategic N application has received much attention. Changing agricultural policies suggest that chemical fertilizer inputs may be diminished and that alternative sources of nutrients are desired. The aim of this study was to evaluate the effect of N and K fertilization on production, botanical composition, and forage mineral composition to gain some insight into what influence changing fertilization practices would have on pasture productivity. Three K and 3 N application rates were applied in a factorial design on a white clover (Trifolium repens L.)—perennial ryegrass (Lolium perenne

L.) sward. Potassium and nitrogen application increased herbage production and had differential influences on botanical composition. Nitrogen decreased clover content in the pasture, whereas K increased the proportion and production of white clover. The effects of K application appeared later in the experiment than those associated with N. We concluded that K is very important for development and maintenance of white clover in pasture, which increases herbage and protein production. Nitrogen was associated with lesser amounts of N, P, K, and Mg in pasture, because of lesser amounts of clover in the sward. Changing fertilization practices will have definite influences on sward composition and pasture productivity. Any interpretation of pasture mineral content should take botanical composition changes into account.

Bolland M. D. A., I. F. Guthridge, and G. Blincow. 2011. Response of intensively grazed ryegrass dairy pastures to fertiliser phosphorus and potassium. Nutrient Cycling in Agroecosystems, 90:281-298.
Reference ID: 22907
Notes: #22907e
Abstract: Intensively grazed, rain-fed dairy pastures on the predominantly sandy soils in the high rainfall (>800 mm annual average) Mediterranean-type climate of south-western Australia comprise >90% ryegrass (annual ryegrass, Lolium rigidum Gaud. and Italian ryegrass, L. multiflorum Lam.). To maximise pasture use for milk production, the pastures are rotationally grazed by starting grazing when ryegrass plants have 3 leaves per tiller, and fertiliser nitrogen (N) and sulfur (S), in the ratio of 3–4 N and 1S, need to be applied after each grazing for profitable pasture dry matter (DM) production. In addition, farmers usually also apply low levels of phosphorus (P) and potassium (K) fertiliser to these pastures after each grazing, despite Colwell soil test P usually being well above critical values for pasture production, and fertilizer K being only required for clover in the traditional clover (Trifolium subterraneum L.) ryegrass pastures of the region. In field experiments undertaken May 2006–June 2010 on intensively grazed ryegrass dairy pastures in the region, no significant ryegrass DM responses to applied fertiliser P or K were obtained, regardless of level or method of P or K application. When no P was applied, soil test P declined gradually, by between 4.4 and 7.1 mg/kg per year, and remained above the critical value for the soils at 2 sites, but declined below the critical value for soil at a third site. Critical soil test P is located near the maximum yield plateau in the flat part of the relationship between yield and soil test P, particularly when, as appropriate for dairy production, the critical value is for 95% of the maximum pasture DM yield. Consequently, when no P is applied and soil test P decreases, significant pasture DM yield decreases will only occur when soil test P approaches the steeper part of the relationship, which can take some time. In addition, as occurs on farms, faeces deposited by cows while grazing supplied P to pasture even when no fertiliser P was applied. Soil K testing proved unreliable for indicating the need for fertiliser K applications to pasture in the next growing season because many soil samples collected within and between urine patches contained elevated levels of K deposited by cows while grazing. We conclude fertiliser P should only be applied to intensively grazed ryegrass dairy pastures when soil testing indicates it is required. Further research is required to assess if plant K testing is an alternative, but urine patches may also pose a problem for plant testing.

Campkin R. 1985. Model for calculating potassium requirements for grazed pastures. New Zealand Journal of Experimental Agriculture, 13:27-37.
Reference ID: 22908
Notes: #22908e
Abstract: A model has been developed for calculating the potassium (K) requirements of grazed pastures. It assesses K losses in animal products, in transfer from the grazing area, and in drainage, using knowledge of the type of stock, stocking rate, land slope, and mean annual rainfall. Potassium supplied by the soil from residual fertiliser K and through weathering of clay minerals is then subtracted from these losses to give the fertiliser required. An adjustment can be made for those areas which lose or receive extra K in hay or silage.

McKenzie F. R., J. L. Jacobs, M. Ryan, and G. Kearney. 1998. Spring and autumn nitrogen fertiliser effects, with and without phosphorus, potassium and sulphur, on dairy pastures: Yield and botanical composition. African Journal of Range & Forage Science, 15:102-108.
Reference ID: 22909
Notes: #22909e
Abstract: Experiments were conducted at three sites to study effects of different nitrogen (N) fertilisers (e.g. urea, ammonium nitrate, di-ammonium phosphate and ammonium sulphate), applied at 45 kg N ha-1, with and without phosphorus (P), potassium (K) and sulphur (S), on pasture dry matter (DM) yield and botanical composition. Autumn and spring applied N increased DM yield at all sites. Different N fertilisers generally produced similar DM yield increases. Where different N fertiliser types were balanced with respect to P, K and S there was a similar marginal, but usually nonsignificant (P=0.05) increase in DM yield over unbalanced N fertiliser types. Average autumn N response efficiencies (excluding P, K and S) at Sites 1, 2 and 3 (after 47, 34 and 37 days, respectively) were 10:1 (10 kg DM per kg N), 16:1 and 13:1, respectively. Including P, K and S, N response efficiencies were 12:1, 17:1 and 15:1, respectively. Residual N response efficiencies without P, K and S (after 50, 41 and 29 days at Sites 1, 2 and 3, respectively), were 5:1, 5:1 and 3:1, respectively. When P, K and S were included, N residual response efficiencies were 6:1, 6:1 and 4:1, respectively. Average spring N response efficiencies at Sites 1, 2 and 3 (without P, K and S) after 29, 30 and 26 days, respectively were 9:1, 6:1 and 16:1, respectively. Including P, K and S, N response efficiencies were 12:1, 7:1 and 17:1, respectively. Residual N response efficiencies (excluding P, K and S) were 6:1, 6:1 and 7:1 at Sites 1, 2 and 3 after 21, 20 and 21 days, respectively. Including P, K and S, average N residual response efficiencies were 5:1, 7:1 and 8:1, respectively. The botanical composition of the pasture was unaffected by the application of N.

McKenzie F. R., J. L. Jacobs, M. Ryan, and G. Kearney. 1998. Spring and autumn nitrogen fertiliser effects, with and without phosphorus, potassium and sulphur, on dairy pastures: Pasture nutritive value and mineral content. African Journal of Range & Forage Science, 15:109-116.
Reference ID: 22910
Notes: #22910e
Abstract: Experiments were conducted at three sites to examine effects of applying different nitrogen (N) fertilisers at 45 kg N ha-1, with and without phosphorus (P), potassium (K) and sulphur (S) on dairy pasture nutritive value and mineral content in autumn and spring. Pasture nutritive value was assessed by measures of crude protein (CP), metabolisable energy (ME), water-soluble carbohydrates (WSC) and

neutral detergent fibre (NDF). Pasture mineral content was assessed by estimates of the major minerals phosphorus (P), potassium (K), sulphur (S), sodium (Na), calcium (Ca), and magnesium (Mg), and trace minerals manganese (Mn), iron (Fe), copper (Cu) and zinc (Zn). Apart from some exceptions, applications of N, with and without additional P, K and S generally increased pasture CP and ME content in autumn and CP content in spring. Again with some exceptions, pasture WSC content was unaffected by fertiliser application in autumn, but was decreased by some treatments (containing N and N with P, K and S) in spring. Fertiliser treatments generally had no effect on pasture NDF content at Sites 1 and 3 during autumn and spring. At Site 2, some treatments (containing N and N with P, K and S) reduced pasture NDF content in autumn while during spring some treatments (containing N and N with P, K and S) increased pasture NDF content. Different N fertilisers applied at the same rate, with and without additional P, K and S, generally produced the same effect on pasture nutritive value. The application of P, K and S in the absence of N generally had no effect on pasture nutritive value. Apart from some exceptions, pasture P content was increased by fertiliser treatments including P, K and S, but N on its own did not influence pasture P content. Pasture K content was generally not influenced by treatment. At Site 1 during autumn and spring, and at Site 3 during spring, treatments containing P, K and S increased pasture S content while applications of N had no effect. At Site 2 during autumn, P, K and S increased pasture S content relative N only, while during spring pasture S content was generally increased by all treatments. At Site 3 during autumn, applications of N decreased pasture S content while P, K and S increased pasture S content relative to no fertiliser. Pasture Na and Ca content were generally not influenced by treatment. Pasture Mg content was not influenced by treatment at Sites 2 and 3. At Site 1 during autumn and spring, however, some treatments (containing N and N with P, K and S) increased pasture Mg content. Fertiliser treatments produced no consistent patterns or differences with respect to trace minerals (Mn, Fe, Cu and Zn).

Adams S. N. 1973. The response of pastures in Northern Ireland to N, P and K fertilizers and to animal slurries: II. Effects of mineral composition. Journal of Agricultural Science, 81:419-428.
Reference ID: 22911
Notes: #22911e
Abstract: Herbage samples from 16 trials testing the effects of N, P and K fertilizers and slurry on grassland were analysed for % N, P, K, Ca, Mg and Na. The data were examined to see if a fertilizer policy designed for optimum yield should be modified after taking pasture mineral content into account.
The correct fertilizer nitrogen policy appears to be to apply nitrogen for the desired yield and to disregard any effects on mineral content. The correct fertilizer policy for phosphorus and potassium is to steer a middle course between depleting soil reserves and accumulating undesirable excesses. The quantities of phosphorus and potassium which should be applied to cut grass to maintain the status quo in the soils are discussed. The amount of phosphorus and potassium added in slurry must be allowed for in this calculation. As the amount of slurry available depends upon the farming system, an effective fertilizer policy for phosphorus and potassium can only be devised by studying the farm as a whole.
At the first cut, the slurries provided on average 115 kg NH4-N/ha, 114 kg K/ha and 86 kg P/ha. Slurry potassium was somewhat less than half as effective as fertilizer potassium in increasing % K in the herbage at the first cut. Furthermore, the herbage recovered only 0·8 kg of the 86 kg of slurry phosphorus. In the short term, slurry was

only just over 10% as effective as fertilizer phosphorus, presumably because much phosphorus in it is organically bound.

Morton J. D., L. C. Smith, K. G. Dodds, and W. D. Catto. 2001. Balanced and adequate potassium and phosphorus nutrition of pasture. New Zealand Journal of Agricultural Research, 44:269-277.
Reference ID: 22912
Notes: #22912e
Abstract: Pasture production responses from applications of four rates each of potassium (K) (0, 112.5, 225, 450 kg ha-1) and phosphorus (P) (0, 60, 120, 240 kg ha-1) in a factorial design were measured in a mowing trial with 60% of clippings returned at a K- and P-responsive site (54.6 µg K ml-1 and 9 µg Olsen P ml-1) at Woodlands in Southland, New Zealand over 2 years. There were large significant responses in total pasture dry matter (DM) production to K and P. A bivariate Mitscherlich-related equation accounted for 97% of the variation in measured values of total DM yield, 94–99% of the variation in ratios of K, P, and nitrogen (N) concentrations in mixed herbage, and 99–100% of the variation in nutrient ratios in white clover, summed or averaged over 2 years. The fitted equations were used to identify combinations of fertiliser P and K rates and ratios of K and P concentrations in mixed herbage and clover that resulted in balanced and adequate nutrition. Two nutrient elements are in balance when the yield response to one added on its own equals the response to the other added on its own, both in relation to the maximum yield. Balanced nutrition in total DM occurred at a K/P ratio of 5.1–7.4 for mixed herbage and 4.2–7.9 for clover, and were highest at higher rates of K and P. For balanced nutrition at 95% relative yield, K/P ratios were 6.8 for clover and 6.7 for mixed herbage. Fertiliser K/ (K + P) ratios for balanced nutrition increased from 0.5 for fertiliser expenditure of $50 ha-1 to 0.7–0.8 for expenditure of $100–200 ha-1. Modelled yield at the fertiliser K/(K + P) ratio for balanced nutrition in mixed herbage and clover DM was similar to maximum modelled yield. Mixed herbage and clover K/P ratios derived from economically optimal fertiliser K/P ratios were 6.2–6.6 and 5.6–6.7, respectively. Using N concentration as an internal standard, nutrient adequacy is defined as the herbage yield with K and P in physiological balance relative to the maximum yield with K and P in physiological balance and expressed as RY [KP]. At 95% RY [KP], adequate nutrition was achieved at K/N of 0.77 for mixed herbage and 0.46 for clover. Overall, the results from the trial reported here confirm that ratios of nutrient concentrations are useful indicators of balanced and adequate K and P nutrition for total pasture production. Mixed herbage or clover nutrient concentrations and ratios were both effective indicators of balanced and adequate nutrition.

Adams S. N. 1978. The response of pastures in Northern Ireland to N, P and K fertilizers and to animal slurries: I. Effects on dry-matter yield. Journal of Agricultural Science, 81:411-417.
Reference ID: 22913
Notes: #22913e
Abstract: Sixteen factorial experiments made from 1969 to 1971 on Northern Ireland pastures measured effects on yield of 0, 180 or 360 kg of N, 0, 30 or 60 kg of P and 0, 150 or 300 kg of K/ha/year both with and without 138,000 1 of slurry/ha. Without slurry, pasture yield was almost always substantially increased by nitrogen, slightly by potassium and hardly at all by phosphorus. There was a slight positive interaction between nitrogen and potassium, but no other interactions. Response to

nitrogen was not linear and therefore was lower than has been obtained in many British trials.
Slurry sharply reduced response to nitrogen and virtually eliminated response to phosphorus and potassium. The NH4-nitrogen content of slurry gave an adequate measure of its effect on pasture yield. The nitrogen, phosphorus and potassium contents of the most concentrated slurries were 15, 29 and 36 times respectively those of the most dilute batches. Hence considerable imprecision is brought into a fertilizer programme when slurry is applied.
As manuring on individual fields can never be precise, the fertilizer phosphorus and potassium needed for grassland is best assessed by considering the farm as a whole. A nutrient balance can show if the farming system is gaining or losing phosphorus and potassium. The amounts of fertilizer phosphorus and potassium needed are those which cover any deficits on the farm as a whole.

Adams S. N. 1974. The response of pastures in Northern Ireland to N, P and K fertilizers and to animal slurries: III. Effects in experiments continued for either two or three years. Journal of Agricultural Science, 82:129-137.
Reference ID: 22914
Notes: #22914e
Abstract: Three factorial experiments made in 1969 on Northern Ireland pastures to measure effects upon yield and mineral content of 0, 180 and 360 kg N, 0, 30 or 60 kg P and 0, 150 or 300 kg K/ha/year, both with and without 1380001 slurry/ha, were continued on the same sites with the same treatments in 1970 and two of them were continued again in 1971.
Responses to nitrogen in the second and third seasons were similar to those of the first season. There was no evidence that large nitrogen dressings plus slurry were causing nitrogen to accumulate in the soil.
Repeated cutting of herbage given neither fertilizer potassium nor slurry was beginning to reduce both yield and the potassium content of the herbage in the second and third years. Giving fertilizer potassium prevented these losses, but the potassium in the slurries was less effective because it did not maintain the potassium content of the herbage. Reasons for, and implications of this effect are discussed. There was no evidence that soil phosphorus reserves were becoming depleted, when judged by the % P in herbage receiving neither fertilizer nor slurry even after the herbage had been cut and removed for two or three years. As there was no immediate need for fertilizer phosphorus, the P in the slurries, even though slower acting than that in mineral fertilizers, seemed suitable for maintaining the phosphorus status of these pasture soils.

Morton J. D. 1981. Influence of trial management on pasture response to potassium on a pakihi soil. New Zealand Journal of Experimental Agriculture, 9:271-277.
Reference ID: 22915
Notes: #22915e
Abstract: A grazing trial showed no significant responses in soil potassium, pasture yield, or animal performance to applications of potassium chloride above 50 kg/ha on an Addision soil at Bald Hill near Westport, South Island, New Zealand. Continuous mowing plot trials however, showed large pasture yield responses to applied KCl regardless of whether clippings were returned or discarded. An occasional cuts technique with grazing between cuts showed a reduced response. It is suggested that the small plot trials over-estimated the K requirements of pasture on this soil and that

the grazing trial demonstrated the efficiency of K recycling under the management used in the trial.

Williams P. H., J. D. Morton, and B. L. J. Jackson. 1986. Chemical soil test prediction of pasture responses to potassium on recent soils of the South Island west coast. New Zealand Journal of Experimental Agriculture, 14:411-415.
Reference ID: 22916
Notes: #22916e
Abstract: Pasture yield responses to potassium (K) fertiliser were measured at 13 sites which had low levels of exchangeable K but varying amounts of non-exchangeable K. Of soil tests which measured available K (STK), exchangeable K (Kex), and non-exchangeable but plant-available K (TPBK) in the top 7.5 cm of soil, Kex gave the best correlation with relative yield. Further down the profile where exchangeable levels were low but non-exchangeable K levels were very high, only the TPBK test indicated the size of this potential source of K. Information from these soil tests can be used in mathematical models to predict fertiliser requirements for pasture.

Gilhaus K. and N. Holzel. 2015. Seasonal variations of fodder quality and availability as constraints for stocking rates in year-round grazing schemes. Agriculture, Ecosystems & Environment, 2015:1-11.
Reference ID: 22917
Notes: #22917e
Abstract: Year-round grazing by free-roaming herds of cattle and horses is increasingly applied for conservation management of grasslands. In such grazing schemes, periods of fodder shortage can occur in winter and early spring, but supplementary feeding is usually avoided. Hence, stocking rates have to be adjusted precisely to seasonal fodder availability for animal welfare reasons. We investigated the seasonal changes of biomass quantity and quality at four year-round pastures in northwest Germany, two on nutrient-rich and two on nutrient-poor soils. In total, 248 biomass samples were taken in spring, summer, fall and winter 2013 and 2014, and across different vegetation types. The samples were analyzed for fiber contents, calcium, magnesium, potassium and crude protein. Maximum grazing capacities for all pasture and vegetation types were calculated for each season and for cattle and horses separately. Overall, biomass quantity and nutrient contents were lower in nutrient-poor than nutrient-rich sites. Biomass quality varied less over the year at nutrient-rich compared to nutrient-poor sites. At nutrient-rich sites, a greater fluctuation in biomass quantity was measured over the year. In spring, biomass quantity was lowest in both pasture types, whereas nutrient values were lowest in spring at nutrient-poor and lowest in winter at nutrient-rich sites. Calculated grazing capacities were lowest in spring in both pasture types, but were limited by nutrient content at nutrient-poor sites and by biomass quantity at nutrient-rich sites. Hence, an adjustment of stocking rates simply to fodder quantity seems possible at nutrient-rich sites, whereas at nutrient-poor sites calculations under consideration of nutrient contents are recommendable. Especially for cattle, some nutrient contents of biomass were below requirements in winter and spring at nutrient-poor sites so that we rather propose grazing by horses or nutrient supplementation during the winter season. This study showed that adequate livestock nutrition under year-round grazing is possible, but that additional feeding or other measures might be necessary when pasturing very nutrient-poor habitats.

Morton J. D., L. C. Smith, and A. K. Metherell. 1999. Pasture yield responses to phosphorus, sulphur, and potassium applications on North Otago soils, New Zealand. New Zealand Journal of Agricultural Research, 42:133-146.
Reference ID: 22918
Notes: #22918e
Abstract: Abstract Pasture yield responses to phosphorus (P), sulphur (S), and potassium (K) were measured over four to eight years on different yellow-grey earth (pallic) soils at three non-irrigated (Timaru, Kauru, and Claremont soils) and one irrigated (Otiake soil) sites in North Otago. Large pasture yield responses to P at application rates up to 80 kg ha-1 yr-1 occurred on three sites with initial soil Olsen P levels of 6-11 µg ml-1, but only a small response up to this rate was measured on the Timaru soil with a higher initial soil Olsen P level (16 µgml-1). The relationship between soil Olsen P and relative annual pasture yield was similar and moderate (r2 = 0.57) for the average of the three most responsive sites. The highest pasture yield response to S was measured at application rates up to 80 kg ha-1 yr-1 on an Otiake soil with an initial soil sulphate S level of 3 µg g-1. Smaller pasture yield responses at rates up to 40 kg S ha-1 yr-1 occurred on Kauru and Timaru soils with initial soil sulphate S levels of 8 and 4 µg g-1, respectively. In four of the eight years there was a pasture yield response up to 10 kg S ha-1 yr-1 on the Claremont soil with an initial soil sulphate S level of 9 µg g-1. Soil sulphate S only accounted for a small proportion (27%) of the average variation in relative yield. Three of the four sites had medium to high initial soil quick test (QT) K levels (9-19) and the fourth (Otiake soil) had a low level (4). Over four to eight years, the soil QT K in the nil K treatments declined to 2-7, but there was a pasture yield response only in the last four years at the lowest level, on the Otiake soil. Soil potassium tetra-phenyl boron levels were increased by K application and showed a lower decline than for no K. There was a moderate to strong relationship measured between relative yield (% of maximum yield) and %P (r2 = 0.58) and %S (r2 = 0.83) in mixed herbage on the Otiake soil but not at the other sites. %P was related to Olsen P (r2 = 0.52-0.69) on the Claremont and Otiake soils and %S was related to soil sulphate S (r2 = 0.51) for the mean of all four sites. Overall, the results show that North Otago yellow-grey earth soils can be responsive to P, S, and K, and the size of the pasture yield response can be predicted with a reasonable degree of accuracy by the level of available soil P, S, and K, the amount of soil reserve K, and the P, K, and S concentration in mixed herbage.

McMahon P., H. bin Purung, S. Lambert, S. Mulia, Nurlaila, A. W. Susilo, E. Sulistyowati, S. Sukamto, M. Israel, A. Saftar, A. Amir, A. Purwantara, A. Iswanto, D. Guest, and P. Keane. 2015. Testing local cocoa selections in three provinces in Sulawesi: (i) Productivity and resistance to cocoa pod borer and Phytophthora pod rot (black pod). Crop Protection, 70:28-39.
Reference ID: 22919
Notes: H 8.1.4.2 #22919
Abstract: Trials were established on smallholder cocoa farms in three provinces in Sulawesi to assess productivity and constitutive responses of local cocoa clones to cocoa pod borer (CPB) and Phytophthora pod rot (Ppr) in different environmental situations. Twelve clones per trial (local farmer-assisted selections or clones produced by hybridisation programs in East Java and Malaysia) were tested in the districts of Pinrang, Polewali-Mandar and North Kolaka, including four standards common to the trials: the Malaysian clone, PBC123, and three selections from Sulawesi farms. The clones were evaluated from the time they started fruiting in 2010 (about two years after planting) for two years during which time chemical pesticides were not applied.

Otherwise farms were managed according to recommended practices, including harvesting each fortnight, fertiliser application and heavy and light pruning, depending on the season. Butter fat content was generally lower than 50% but was higher in three local selections in Pinrang, M04, RB and Panimbu Red. While strongly dependent on genotype, fat and shell content and pod values in the common standards showed some variation between sites. The bean size and fat content of PBC123 was low, but this clone yielded better than most of the clones tested. For the common standards, yield estimates obtained from average yield per tree were higher in Pinrang (735–1100 tons/ha/annum) than in N. Kolaka (342–894 ton/ha/annum) or Polewali-Mandar (485–899 tons/ha/annum) indicating a marked site-effect. The number of flowers produced was higher in the common standards in Pinrang. Soil parameters including pH and exchangeable calcium, magnesium and potassium were higher in Pinrang than in Polman, although both sites were deficient in soil nitrogen and organic carbon. Lower average CPB infestation rates in ripe pods for the two-year evaluation period occurred in Pinrang (48–66%) and Polewali-Mandar (19–68%) than in N. Kolaka (77–80%). In most of the clones, total and severe CPB incidence decreased during the high pod season but some selections, such as M04 and TR01, maintained a low total and severe CPB incidence in both the low and high pod seasons, indicating partial resistance. In the ripe pods of common standards, the highest average Ppr incidence (ranging from 10 to 14%) occurred in N. Kolaka, which had a higher annual rainfall than the other sites. In ripe pods in the Pinrang trial, Geni J, M06 and Panimbu Red had a low Ppr incidence (4.4–4.8%) while M04 was Ppr-susceptible (23%). Incidence of Helopeltis spp. was high in the immature pods of some clones (exceeding 30% of the total harvest in M01 and Geni J in Pinrang). The results show that the performance of clones is affected by the locality in which they are grown, as well as their genotype, indicating the importance of testing clones under different environmental conditions. While the trials confirmed the efficacy of farmer-assisted selection, they also indicated that clones resistant to CPB, were susceptible to Ppr or other pests/diseases, and vice versa. For example, local selection, M04, was highly susceptible to Ppr, yet resistant to CPB. Therefore, the results indicate the importance of efforts to screen the progeny of hybrid crosses that combine resistance and yield traits.

Susilo A. W., D. Zhang, L. A. Motilal, S. Mischke, and L. W. Meinhardt. 2016. Assessing Genetic Diversity in Java Fine-Flavor Cocoa (Theobroma cacao L.) Germplasm by Using Simple Sequence Repeat (SSR) Markers. Tropical Agriculture and Development, 55:84-92.
Reference ID: 22920
Notes: H 8.1.4 #22920
Abstract: Indonesia is the 3rd largest cocoa-producing country in the world. The cacao varieties currently cultivated in Indonesia are inter-hybrids of various clones introduced from the Americas since the 16th century. Among them, "Java cocoa" is a well-known fine cocoa specialty product which was originally selected from crosses between "Java Criollo" trees and an unknown parent at Djati Roenggo, Java in 1912. Using simple sequence repeat (SSR) markers, we analyzed the genetic diversity and population structure of fine-flavored cacao germplasm from Java, and compared the results with those of bulk cocoa in the same region. Although a high level of heterozygosity was observed in the fine-flavored cacao clones (Ho=0.660; He=0.674), indicating their hybrid origin, the allele richness in the Java cacao germplasm was moderate (7.6 alleles per locus). Principal Coordinate Analysis (PCoA) showed that the genetic structure of Java cocoa is heterogeneous, including genetic background of Trinitario, Upper Amazon and Lower Amazon Forastero. Parentage analysis supported the

passport records of parental contribution from Venezuelan landraces to some DR clones (DR 1 and DR 38), which are the main clones used to produce Java cocoa, but excluded the direct parentage of pure Criollo. Sibship reconstruction indicated that the DR clones did not originate from a single cross as previously considered. The resultant information improved our analysis of the diversity and ancestry of Java cocoa. It also suggested the need for broadening the genetic background in the Java cocoa germplasm.

Oberthür T. 2016. Plant Intelligence & Estate Scale Experimentation (P1 & ESE): Management Processes for Plantation Operators: Intelligencia de plantaciones para la correcta toma de decisiones en campo: Gestion de procesos para operadores de plantaciones. Pages 13, 103-16, 105 Grepalma.
Reference ID: 22921
Notes: #22921e > S 8.1.1 #22869
(In English and Spanish, Abstract Only)
Abstract: Plantation Intelligence & Estate Scale Experimentation (PI&ESE) are management processes that have their origin in concepts from manufacturing. These concepts describe how managers use information and control technologies to improve efficiency and profitability of manufacturing. Some time ago, it occurred to us that there was scope for better systems of managment in agriculture; not just oil palm, but all forms of agricultural management. The principle of better management we pursued was improved control of production processes, enabled by information. The change we sought was systemic. The processes hinge on conceptual models that link available data about actual yield variation (i.e. production) and site characteristics in a managed system.

ISP. The Planter Vol 92 No 1083 June 2016. [92], 355-428. 2016. Kuala Lumpur, ISP.
Reference ID: 22922
Notes: S serial #22922
Abstract:
Articlel: New Dimensions in Palm Oil Mill Effluent (POME) Treatment Using Biotech Based Treatment System **#22923**
RSPO PalmGHG, ISCC and ISPO GHG Calculator - A Comparative Analysis **#22924**

Chung C. H. and S. Y. Cheong. 2016. New Dimensions in Palm Oil Mill Effluent (POME) Treatment Using Biotech Based Treatment System. The Planter, 92:363-378.
Reference ID: 22923
Notes: #22923 > S serial #22922
Abstract: Most Malaysian palm oil mills have adopted the open lagoon method as their effluent treatment system. There are numerous problems confronting these mills as far as effluent discharge is concerned. In Sabah, the Malaysian Department of Environment (DOE) requires final effluent discharge of Bio Oxygen Demand (BOD) below 20mg per litre. Currently available in the market are a few technologies which use a standalone or a combination of the mechanical, chemical and biological methods. Most systems fail to consistently and continuously meet the official requirement. A pilot project study in a 45-tonne per hour palm oil mill situated in Sandakan, managed to obtain a 20months continous result of BOD below 20mg per litre. The treatment system in the study primarily uses biological treatment method, i.e. a combination of anaerobic, aerobic digestion process and for final polishing, a multistage activated carbon chambers.

Gan L. T. and H. Cai. 2016. RSPO PalmGHG, ISCC and ISPO GHG Calculator - A Comparative Analysis. The Planter, 92:379-407.
Reference ID: 22924
Notes: #22924e > S serial #22922
Abstract: This paper presents the results of a comparative analysis of three commonly used greenhouse gas (GHG) calculation methodology (referred to as 'calculator' in this paper) by oil palm growers in Indonesia. i.e. the PalmGHG, International Sustainability and Carbon Certification (ISCC) and Indonesian Sustainable palm Oil (ISPO) calculators. The calculators each have a different calculation approach which depends on the specific requirements of each calculator as it was developed. The main objective of this analysis is to enumerate each source of emission and the cumulative impacts which affect the final carbon balance using each of the calculators so that differences between the calculators can be analysed. Several examples were used to illustrate the impact of the differences between these calculators.

Dupraz P.and R. Lifran. 1995. The Economic Complementarity of Cocoa and Coconut Intercropping: Asset Strategies of Smallholders in Malaysia and Implications for Cocoa Supply. Pages 281-289 *in* Fe Ruf and PS Siswoputranto, editors. Cocoa Cycles: The Economic of Cocoa Supply. Woodhead Publishing Limited.
Reference ID: 22925
Notes: H 8.1.4 #22925e > S 8.1.4 #20693 (chapter 14)
Abstract: The mixed cropping of cocoa and coconut is a relatively recent technique practised in Malaysia. Introduced in the 1970s in response to the coconut crisis, it is not specific to small plantations (see Table 1). Well mastered by the Malay farmers, the technique is likely to spread to Indonesia, where the area under coconut is large and where the labour force is abundant (Bourgeois, 1988). Therefore, in the economic analysis of the cocoa-coconut crop in smallholder farms, much more is at stake than the quantative importance of this cropping pattern for Malaysia. The aim of this paper is to show that an economic analysis carried out at the level of farm households can lead to an understanding of the major dynamics at work in cocoa farming systems. The analysis is based on the observations made by P. Dupraz and M. Morisson in the two west coast Malaysian villages. However, cocoa is a relatively minor crop as compared to coconut, both in terms of income generation and wealth accumulation potential (at least for the smaller plantations of the Malaysian peninsula). Before going further however, it is first necessary to understand and analyze the role of the coconut in the life cycle of smallholder farm households.

Durand F. 1995. Farmer Strategies and Agricultural Development: The Choice of Cocoa in Eastern Indonesia. Pages 315-338 *in* Fe Ruf and PS Siswoputranto, editors. Cocoa Cycles: THe Economic of Cocoa Supply. Woodhead Publishing Limited.
Reference ID: 22926
Notes: H 8.1.4 #22926e > S 8.1.4 #20693
Abstract: Indonesia is playing a decisive role on the world cocoa market of the 1990s. But while at the international level Indonesian cocoa was relatively unknown until 1990, it has long been an element of the agricultural strategies of farmers in the archipelago, who began growing cocoa three centuries ago. After presenting a brief overview of the history of cocoa development in Indonesia, this article focuses on an analysis of farming strategies developed by cocoa farmers in three regions of the Indonesian archipelago: Sulawesi, the Moluccas, and Irian Jaya. An attempt will be made to determine the incentives and/or constraints at work behind farmers' decisions to plant cocoa.

Fertilizer International. Market Outlook: Fertilizer International July/August 2016. Fertilizer International July/August 2016, 6-7. 2016. Buenos Aires, Fertilizer Latino Americano.
Reference ID: 22927
Notes: #22927e

Fertilizer International. Fertilizer Industry News: Fertilizer International July/August 2016. Fertilizer International July/August 2016, 8-11. 2016. Fertilizer Latino Americano.
Reference ID: 22928
Notes: #22928e

Fertilizer International. Fertilizer investment still has steam: The Investment Climate. Fertilizer International July/August 2016, 14-18. 2016. Fertilizer Latino Americano.
Reference ID: 22929
Notes: #22929e
Abstract: Investors have historically viewed the fertilizer industry as a safe prospect due to its highly attractive long-term fundamentals. Although confidence has weakened during the commodities downturn, current investor sentiment towards the fertilizer majors has held up well, when compared to large, diversified mining companies.

Fertilizer International. A demanding business: Global Demand Analysis. Fertilizer International July/August 2016, 32-35. 2016. Fertilizer Latino Americano.
Reference ID: 22930
Notes: #22930e
Abstract: A sophisticated new approach to forecasting and understanding the main drivers of fertilizer demand is explained by Oliver Hatfield of Integer Research. This has revealed some unexpected and surprising underlying drivers of demand for primary nutrients. Predicting future demand also looks like it will become an increasingly complex task in the future.

Fertilizer International. Potash growth shifts east: Potash Outlook. Fertilizer International July/August 2016, 50-53. 2016. Buenos Aires, Argentina, Fertilizer Latino Americano.
Reference ID: 22931
Notes: #22931e
Abstract: Large-scale additions to potash supply in Canada, Russia and Belarus between now and 2020 will create massive regional surpluses in North America and the Former Soviet Union. Much of this extra potash supply will be exported to meet growing demand in East Asia, Latin America and South Asia. The East Asian region, and China in particular, is facing a growing supply deficit and likely to remain the world's largest potash import market over the medium-term.

Clough Y., V. V. Krishna, M. D. Corre, K. Darras, L. H. Denmead, A. Meijide, S. Moser, O. Musshoff, S. Steinebach, E. Veldkamp, K. Allen, A. D. Barnes, N. Breidenbach, U. Brose, D. Buchori, R. Daniel, R. Finkeldey, I. Harahap, D. Hertel, A. M. Holtkamp, E. Horandl, B. Irawan, I. N. S. Jaya, M. Jochum, B. Klarner, A. Knohl, M. M. Kotowska, V. Krashevska, H. Kreft, S. Kurniawan, C. Leuschner, M. Maraun, D. N. Melati, N. Opfermann, C. Perez-Cruzado, W. E. Prabowo, K. Rembold, A. Rizali, R. Rubiana, D. Schneider, S. S. Tjitrosoedirdjo, A. Tjoa, T. Tscharntke, and S. Scheu. 2016. Land-

use choices follow profitability at the expense of ecological function in Indonesia smallholder landscape. Nature Communications, 1-12.
Reference ID: 22932
Notes: H 18 #22932e
Abstract: Smallholder-dominated agricultural mosaic landscapes are highlighted as model production systems that deliver both economic and ecological goods in tropical agricultural landscapes, but trade-offs underlying current land-use dynamics are poorly known. Here, using the most comprehensive quantification of land-use change and associated bundles of ecosystem functions, services and economic benefits to date, we show that Indonesian smallholders predominantly choose farm portfolios with high economic productivity but low ecological value. The more profitable oil palm and rubber monocultures replace forests and agroforests critical for maintaining above- and below-ground ecological functions and the diversity of most taxa. Between the monocultures, the higher economic performance of oil palm over rubber comes with the reliance on fertilizer inputs and with increased nutrient leaching losses. Strategies to achieve an ecological-economic balance and a sustainable management of tropical smallholder landscapes must be prioritized to avoid further environmental degradation.

Schroth G., P. Laderach, A. I. Martinez-Valle, and C. Bunn. 2016. From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa. Mitigation And Adaptation Strategies For Global Change, 1-25.
Reference ID: 22933
Notes: #22933e
Abstract: The production of tropical agricultural commodities, such as cocoa (Theobroma cacao) and coffee (Coffea spp.), the countries and communities engaged in it, and the industries dependent on these commodities, are vulnerable to climate change. This is especially so where a large percentage of the global supply is grown in a single geographical region. Fortunately, there is often considerable spatial heterogeneity in the vulnerability to climate change within affected regions, implying that local production losses could be compensated through intensification and expansion of production elsewhere. However, this requires that site-level actions are integrated into a regional approach to climate change adaptation. We discuss here such a regional approach for cocoa in West Africa, where 70 % of global cocoa supply originates. On the basis of a statistical model of relative climatic suitability calibrated on West African cocoa farming areas and average climate projections for the 2030s and 2050s of, respectively, 15 and 19 Global Circulation Models, we divide the region into three adaptation zones: (i) a little affected zone permitting intensification and/or expansion of cocoa farming; (ii) a moderately affected zone requiring diversification and agronomic adjustments of farming practices; and (iii) a severely affected zone with need for progressive crop change. We argue that for tropical agricultural commodities, larger-scale adaptation planning that attempts to balance production trends across countries and regions could help reduce negative impacts of climate change on regional economies and global commodity supplies, despite the institutional challenges that this integration may pose.

Schroth G., P. Laderach, A. I. Martinez-Valle, C. Bunn, and L. Jassogne. 2016. Vulnerability to climate change of cocoa in West Africa: Patterns, opportunities and limits to adaptation. Science of the Total Environment, 556:231-241.
Reference ID: 22934
Notes: #22934e

Abstract: The West African cocoa belt, reaching from Sierra Leone to southern Cameroon, is the origin of about 70% of the world's cocoa (Theobroma cacao), which in turn is the basis of the livelihoods of about two million farmers. We analyze cocoa's vulnerability to climate change in the West African cocoa belt, based on climate projections for the 2050s of 19 Global Circulation Models under the Intergovernmental Panel on Climate Change intermediate emissions scenario RCP 6.0. We use a combination of a statistical model of climatic suitability (Maxent) and the analysis of individual, potentially limiting climate variables. We find that: 1) contrary to expectation, maximum dry season temperatures are projected to become as or more limiting for cocoa as dry season water availability; 2) to reduce the vulnerability of cocoa to excessive dry season temperatures, the systematic use of adaptation strategies like shade trees in cocoa farms will be necessary, in reversal of the current trend of shade reduction; 3) there is a strong differentiation of climate vulnerability within the cocoa belt, with the most vulnerable areas near the forest-savanna transition in Nigeria and eastern Côte d'Ivoire, and the least vulnerable areas in the southern parts of Cameroon, Ghana, Côte d'Ivoire and Liberia; 4) this spatial differentiation of climate vulnerability may lead to future shifts in cocoa production within the region, with the opportunity of partially compensating losses and gains, but also the risk of local production expansion leading to new deforestation. We conclude that adaptation strategies for cocoa in West Africa need to focus at several levels, from the consideration of tolerance to high temperatures in cocoa breeding programs, the promotion of shade trees in cocoa farms, to policies incentivizing the intensification of cocoa production on existing farms where future climate conditions permit and the establishment of new farms in already deforested areas.

Edmeades D. C., J. D. Morton, J. E. Waller, A. K. Matherell, A. H. C. Roberts, and P. Carey. 2010. The diagnosis and correction of potassium deficiency in New Zealand pastoral soils: a review. New Zealand Journal of Agricultural Research, 53:151-173.
Reference ID: 22935
Notes: #22935e
Abstract: Field-trial data from a database comprising records of 804 potassium (K) fertiliser trials were used to define the production functions relating exchangeable soil K (quick test K (QTK) 0–75 mm) to the relative response to fertiliser K applications, for the major soil groups in New Zealand. For all soil groups for which there were sufficient data, the production functions were generally flat in the range QTK 5–10, and thus the estimated relative pasture production at QTK 5 and QTK 10 were similar. The critical QTK levels to achieve 97% maximum production were relatively well defined, being 6 (5–8) for sedimentary soils (brown and pallic) and brown soils, and 7 (5–10) for pumice soils. The data for the allophanic soils were unstable and the best estimate was 6 (5–10). For the remaining soils groups (podzols and raw soils, organic, recent and gley soils) for which there was much less data, the relationships were essentially flat over the range QTK 2–10. The probability of pasture responses to applied K increased as soil QTK decreased from 10. For the sedimentary and volcanic soils (including both allophanic and pumice) the probability was about 70–80% at soil QTK < 2. The comparable probabilities were 50–60% for the recent and gley soils, and 30–43% for the podzols and raw soils. A feature of the response functions was that some trials were not responsive to fertiliser K despite having low soil QTK. In most cases this could not be attributed to soil K reserves as measured by the soil TBK test (sodium tetra-phenol-boron extractable which measures exchangeable K plus plant-available but non-exchangeable K). Other possible reasons for this feature in the data are discussed, including uptake of K from below the soil sampling depth and the temporal

effects of clover responses to applied K. Soil K buffer capacities—the amount of fertiliser K over and above maintenance required to increase soil QTK by 1 unit (?K)—ranged from 50 to > 150 kg K ha-1 (average 124) for sedimentary soils. For some soils (developed organic soils, gleyed soils and podzols), fertiliser K had very little effect on QTK (0–75 mm). It is not clear whether these differences are due to differences in leaching of K from the sampling depth, differences between soils in their ability to absorb and retain applied K or indeed the result of errors in the measurement of this parameter. Estimated maintenance K requirements (i.e. the amount of applied K required to maintain soil QTK levels) increased with increasing soil QTK from 4 to 10, from 0–150 kg K ha-1 yr-1 to 100–300 kg K ha-1 yr-1 in situations where losses of K were extreme due to the removal of all harvested clippings. Given the uncertainties in predicting K responses and the amount of fertiliser K required to correct K deficiency, practical suggestions are offered as to how best to diagnose and manage soil K deficiency. Areas for future research to improve the prediction of pasture responses to fertiliser K are also included.

Bruulsema, T. Soil Phosphorus Trends in the Lake Erie Region. Better Crops With Plant Food 100[2], 4-6. 2016. USA, IPNI.
Reference ID: 22936
Notes: #22936e > S serial #22585e
Abstract: Over the past 15 years, increasing loads of dissolved P into Lake Erie have focused attention on agriculture in its watershed. During the same time period, soil test P levels have declined. Fewer soils now test at extremely high P levels, and nearly half test at levels where crop yields depend directly on annual P application. Opportunities to contribute to P load reductions for Lake Erie include better directing P applications to the soils testing below the optimum range, better timing and placement, and improved integration with other conservation practices in a complete 4R Nutrient Stewardship approach.

Fulford, A. M., Culman, S. W., Mullen, R. W., Dygert, G. A., LaBarge, G. A., Lentz, E. M., and Watters, H. D. Corn and Soybean Response to Phosphorus and Potassium Fertilization in Ohio. Better Crops With Plant Food 100[2], 7-9. 2016. US, IPNI.
Reference ID: 22937
Notes: #22937e > S serial #22585e
Abstract: The most recent fertilizer P and K rate recommendations for corn and soybeans grown in Ohio were last updated in the mid-90s. Research is needed to verify the appropriateness of these recommendations after 20 years. This study found that corn and soybean yield response frequencies to P and K fertilization did not differ much from expectations based on initial soil test levels, but greater than expected soil test declines call for further research.

Diovisalvi, N., Reussi Calvo, N., Divito, G., Izquierdo, N., Echeverria, H. E., and Garcia, F. Can We Improve Nitrogen Management for Sunflower? Better Crops With Plant Food 100[2], 10-12. 2016. US, IPNI.
Reference ID: 22938
Notes: #22938e > S serial #22938e
Abstract: The correct diagnosis of soil N availability for sunfl ower is critical to deciding the right N rate for maximum seed yield and adequate oil and protein concentration. Use of local sensors to characterize in-crop N status will complement any soil N diagnosis.

Prochnow, L., Caires, E., and Rodrigues, C. Phosphogypsum Use to Reduce Subsoil Acidity: The Brazilian Experience. Better Crops With Plant Food 100[2], 13-15. 2016. US, IPNI.
Reference ID: 22939
Notes: #22939e > S serial #22585e
Abstract: Phosphogypsum can help to improve subsoil conditions in certain circumstances, which favors plant root development. Better root growth in acidic soils translates into increased water and nutrient uptake by crops leading to higher yields, profitability, and sustainability.

Li, S., Duan, Y., Chen, Z., Guo, T., and Li, Y. Understanding Potato Yield and Economic Responses to Fertilizer. Better Crops With Plant Food 100[2], 16-18. 2016. US, IPNI.
Reference ID: 22940
Notes: #22940e > S serial #22585e
Abstract: Researchers established a network of field trials in northwest China designed to test the response of potato to N, P, and K fertilizer and the crop sensitivity to price fluctuations. NPK fertilization responses are commonly significant and economic for this important production center.

Tohiruddin L. and H. L. Foster. 2013. Superior effect of compost derived from palm oil mill by-products as a replacement for inoganic fertilisers applied to oil palm. Journal of Oil Palm Research, 25:123-137.
Reference ID: 22941
Notes: #22941e
Abstract: Trials by Sumatra Bioscience have shown that high quality compost can be produced by composting empty oil palm fruit bunches with oil mill effluent in an open windrow system over 25 days. Fifteen tonnes of the final product typically contains 105 kg N, 16 kg P, 168 kg K and 26 kg Mg, which is close to the average nutrient levels applied to oil palm in Sumatra as inorganic fertiliser per year, except for P which is lower in the compost. Thus, compost applied alone clearly has the potential to replace the inorganic fertilisers usually applied to oil palm. Two trials have been carried out to compare the effectiveness of compost and inorganic fertilisers applied to oil palm on a typical volcanic ash soil in North Sumatra and to determine the optimal rate and method of application of the compost. The first trial tested a factorial combination of three rates of compost, urea, rock phosphate and muriate of potash. The highest rate of compost (10 t ha-1 yr-1) applied alone increased the FFB yield from 23.1 up to 26.8 t ha-1 yr-1 over a three-year period, which is an increase of 0.37 t ha-1 yr-1 FFB per tonne of compost applied each year. A similar yield was achieved with 2 kg urea plus 1 kg rock phosphate (there was no response to K fertiliser), which based on the nutrient content of the two materials, indicates that the N and P in the compost were 66% and 37% more effective than the nutrients in the inorganic fertiliser (and confirms that the P content in the compost is more than adequate). The greater efficiency of compost compared to the inorganic fertilisers in supplying N and P to the oil palms was also confirmed by the higher recovery of these nutrients into the palm fronds. The highest yield of 28.7 t ha-1 yr-1 in this trial was achieved with 10 t ha-1 yr-1 compost plus 2 kg urea and 2 kg rock phosphate, indicating that if only compost is applied, the highest rate will be needed to achieve the optimal yield.

20 Mule Team 2016. Boron in soils and plant nutrition: A practical guide to brown fertilization, BORAX, USA.
Reference ID: 22942
Notes: S 21.7.3 #22942e
Abstract: The need for boron (B) as a plant nutrient in crop production was first demonstrated by Katerine Warington in 1923. Since that time, a vast amount of reaserch has been reported on B in a plant nutrition. Soilds play a majot role in determining the plant availability of B - through the effects of soil pH; organic matter content; iron, aluminum oxides and clay mineral content; soil permeability; and moisture retention. Knowledge of local soil types with respect to these factors is the first step in recognizing B needs. Moreover, different plant species exhibit a wide range of need for B and may react differently to high or low levels of available B in soils.

Hoffmann, M., Oberthür, T., Donough, C., Pasuquin, J. M., Rahmadsyah, Abdurrohim, G., Indrasuara, K., Lubis, A., Dolong, T., van Wijk, M., and Whitbread, A. Simulating potential yield in oil palm with PALMSIM: its application in yield gap analysis and the limitations. 2012.
Reference ID: 22943
Notes: #22943e
Tropentag, Gottingen, Germany
Abstract: Knowing the gap between potential (PY) and actual yield (AY) is key to understanding the important of "Best management practices" (BMP), a combination of nutrient, agronomy and harvesting practices, in sustainable intensification of oil palm plantations.

Oberthür, T. and Donough, C. R. Sustainable Intensification with best management practices (BMP) Oil palm in Southeast Asia, Marginal Environments. 2011. Germany.
Reference ID: 22944
Notes: #22944e
Tropentag 2011 University of Bonn 5-7 August 2011 Bonn, Germany

IPNI. Research with Impact! 2016. USA, IPNI.
Reference ID: 22945
Notes: #22945e
Abstract:
THE CHALLENGE:
Small holder coffee farmers who have migrated to the steep slopes of the northeastern Amazon in Peru commonly faced a repeating poverty cycle. Their perennially low yields and incomes prevent adequate reinvestment in their crops. Over time this situation has lead to extreme poverty and family instability. Soil nutrient depletion is a main factor limiting yields. Very little fertilizer is used, biomass production is low, and the risk of soil erosion is high. Eventually families move on in search of new land to start the cycle again.

Gerendas J., C. R. Donough, T. Oberthür, A. Lubis, K. Indrasuara, T. Dolong, G. Abdurrohim, and Rahmadsyah. 2011. Function and Nutrient Status of Sulphur in Oil Palm in Indonesia. Pages 1-4 Tropentag, Bonn.
Reference ID: 22946
Notes: #22946e (note: Abstract form #20118)
Abstract: The nutrient element sulphur (S) has received much less attention than other macro nutrients, although, S and, e.g., Mg are required in similar amounts by oil palm

(OP). The published critical value for frond #17 is 0.2% for both nutrients (FAIRHURST et al., 2005). Sulphur fulfils numerous functions in plant metabolism. It is a component of S-containing amino acids, resulting in the physiological interaction between S and N. Sulphur is also involved in oil synthesis, and a strong response of oil crops to S supply has been reported (PASRICHA and AULAKH, 1991). Sulphur as an essential nutrient has been largely neglected in OP nutrient management, partly because most of the early research on oil palm nutrition has been carried out in Malaysia, where ammonium sulphate (SOA) has for long been the most common N source. In addition, soil organic matter, organic fertilizers, S deposition from natural (volcanic eruption, fires) and manmade resources (industrial pollution), and ground water contribute to the S availability to a crop(PASRICHA and FOX, 1993). In oil palm, major losses of S are attributed to nutrient export by fresh fruit bunches (FFB) and leaching of sulphate. Leaching losses are governed by soil texture(high losses in sandy soils) and the water balance (high losses in high rainfall areas. In Indonesia, urea has been the most often used N source for decades and for reasons of assumed savings dolomite has been used in preference to kieserite (MgSO4 • H2O). Other S containing fertilisers (single superphosphate, SOP) never played a major role in OP fertilisation. Burning of forest has also come under some control in recent years. In summary, over the years the S input has incidentally been reduced, despite continuous S removal with the FFB and losses by leaching. In fact, as early as the 1980's several publications already addressed the issue and predicted more widespread occurrence of S deficiency, as the trend towards using fertilisers low in S and increasing yields continues (NG et al, 1988, SUMBAK, 1983). Consequently, a decline of the S status of OP in Indonesia has been anticipated, but corresponding reports are missing. In the course of the BMP (Best Management Practice) projects on sustainable OP cultivation of the IPNI SEA programme (DONOUGH et al., 2009) nutrient status analysis were carried out and are used here to assess the S status of OP in Indonesia.

Fertilizer International. Sustainability Matters. 1-5. 2016. Fertilizer International Magazine.
Reference ID: 22947
Notes: H 11.5 #22947
Abstract: We review current international initiatives and cooperation on nitrogen use efficiency and phosphorus sustainability. Resource efficiency makes economic and environmental sense. In manufacturing, for example, maximising product output, whilst simulataneously minimising water, energy and material inputs cuts costs and reduces the consumption of non-renewable resources. It can also help reduce exposure to commodity price volatility and minimise resource security riskes in the supply chain.

Fertilizer International. The agronomic benefits of polyhalite. 1-4. 2016. Fertilizer International Magazine.
Reference ID: 22948
Notes: H 25 #22948
Abstract: Sirius Minerals has conducted 150 polyhalite fertilizer trials on 24 crops in 13 countries over the last five years. We report on the latest findings of the company's crop study programme in China and Brazil, and summarise the main agronomic benefits of this multi-nutrient fertilizer.

Murrell, T. S. Nutrient Considerations for Low Corn Prices. Better Crops With Plant Food 100[1], 4-5. 2016. USA, IPNI.
Reference ID: 22949
Notes: #22949e > S serial #22259
Abstract: Corn prices are low and many producers are asking tough questions about their nutrient management programs. Maintaining grain yield and revenue with lower fertilizer bills is possible, but you need to consider all the science.

He P., F. Chen, S. Li, S. Tu, and A. M. Johnston. 2016. Potassium Changes in Soils Managed for Cash or Grain Crops. Better Crops With Plant Food, 100:6-8.
Reference ID: 22950
Notes: #22950e > S serial #22259
Abstract: Analysis of soil test K from soil samples collected over 23 years, and yield responses from over 2,000 field experiments, indicate that any increase in average soil K in China were most attributable to high K fertilizer use on cash crops. Little change in grain crop field soil K was observed over the same period. Urgent site-specifi c K nutrient management is needed in China to address the great variation in soil available K across its different regions and cropping systems.

Larbi A., M. Msallem, S. Mestaoui, M. B. Sai, M. E. Gharous, and H. Boulal. 2016. Fertilization Practices in Tunisian High-Density Olive Planting Systems. Better Crops With Plant Food, 100:9-11.
Reference ID: 22951
Notes: #22951e > S serial #22259e
Abstract: Fertilization within high-density olive plantations needs to be improved to help control tree vigor, reduce environmental impacts, lower cost of production, and increase productivity.

Asomaning E. J. A., R. S. Kwakwa, and W. V. Hutcheon. 1971. Aphysiological studies on an Amazon shade and fertilizer trial at the Cocoa Research Institute, Ghana. Ghana Journal of Agricultural Science, 4:47-64.
Reference ID: 22952
Notes: H 8.1.4.1 #22952e
Abstract: Following the success of an earlier shade and fertilizer trial involving Amelonado cocoa (Cunningham & Lamb, 1959; Cunningham, Smith & Hurd, 1961), another large field trial was laid out in 1959 to test the response of Amazon cocoa to shade and fertilizer. Amazon cocoa comes into bearing at an early age and has a different type of leaf canopy so that the response to either fertilizer or shade is not necessarily the same as for Amelonado. Data on yield are presented in CRIG Annual Report but in order to understand how these differences arise and to gain information on possible means by which yield might be increase still further, it is necessary to trace the course of mature pod production through vegetative growth, flowering, pod setting and cherelle wilting. Physiological data covering 2 years of an earlier Amelonado shade and fertilizer trial were presented by Hurd & Cunningham (1961), and these allow some comparisons to be made with the present data obtained for Amazon cocoa.

Akankwasa K., G. F. Ortmann, W. K. Tushemereirwe, and E. Wale. 2013. Farmers' choice among recently developed hybrid banana varieties in Uganda: A multinomial logit analysis. Agricultural Economics, 52:25-51.
Reference ID: 22953
Notes: H 8.6.2.1 #22953e
Abstract: This paper analyses the effect of farmer characteristics, variety attributes and agro-ecological conditions on farmers' banana variety choice decisions in Uganda. A Multinomial Logit (MNL) model was used to estimate the determinants of variety choice. The results show that M9 was the most preferred hybrid variety, followed by M2 and M14. However, many of the respondents (39.4%) chose Mbwazirume, a local variety, as their most preferred variety. Good taste, large bunch size, soft food and good flavour were the most desirable attributes, while longer maturity period was a notable undesirable attribute. Results from the MNL analysis suggest that small land size, taste and regional location were negatively associated with variety choice, while perceptions that hybrid bananas could reduce food insecurity and tolerance to pests and diseases were positively associated with probabilities of variety choice. Probabilities of choosing hybrids for food security increase in favour of M2 (by 6.13%) and M9 (27.60%), and decrease by 23.05% for M2, 6.89% for M14 and 9.36% for M9 due to taste relative to Mbwazirume. Farmers' involvement in varietal improvement and development programmes is vital for meeting their preferences. Future breeding efforts should consider attributes such as bunch size, good taste, soft food and agronomic characteristics. Farmers with large land sizes should be targeted for on-farm promotional activities to increase the potential adoption and impact of the hybrids. After the hybrids are popularized and used by farmers, there will be a need for an impact study to evaluate their acceptability in terms of household food security and income.

Weigel M. M. and N. P. C. Morillo. 2010. The food acquisition, dietary practices, and nutritional status of minority women of African descent living in tropical South America. ecology of food and nutrition, 39:135-167.
Reference ID: 22954
Notes: H 19.3 #22954e
Abstract: The food acquisition, dietary practices, and nutritional status of rural Afro-Ecuadorian women were compared with other Ecuadorian and Latin American groups. Data were collected by interview, physical examination, repeated 24-hour and 7-day recalls, key-informant interviews, and non-participant observation. The women's food procurement strategies appeared successful since they had improved food security, dietary quality and nutritional status compared to other impoverished groups. Most had normal weight, 28.3% were obese, and 14.9%, underweight. Their dietary base included plantains, fish, wild rodents, coconut, rice, and tropical fruits but consumption of dairy foods, vegetables, bananas and cassava was low. The proportion of dietary energy provided by carbohydrates, lipids, and proteins was 57%, 29%, and 14%. Protein, lipid and cholesterol intakes were elevated. Many had low calcium (87%) and zinc intakes (74%) butfew, low iron intakes (< 35%) excepting gravidas (67%). Similar to the present day trend in the Americas, the minority women's dietary and other lifestyle characteristics appears to place them at risk for the development of obesity and other chronic diseases.

Ahenkorah Y., B. J. Halim, R. M. Appiah, G. S. Akrofi, and J. E. K. Yirenkyi. 1987. Twenty years' results from a shade and fertilizer trial on amazon cocoa (Theobroma cacao) in Ghana. Experimental Agriculture, 23:31-39.
Reference ID: 22956
Notes: H 3.3 #22956
Abstract: Following the success of the earlier Amelonado cocoa (Theobroma cacao) shade and manurial trial (Cunningham and Lamb, 1959; Cunningham et al., 1961; Ahenkorah et al., 1974), a larger and more elaborate field trial involving Amazon cocoa was established in 1959. Reports on the first five years (Ahenkorah and Akrofi, 1968), physiological studies (Asomaning et al., 1971) and the eight year cumulative yield analysis (Ahenkorah and Akrofi, 1977) of this Amazon shade and fertilizer trial have already been published. The trial is now terminated.

Sierra J., N. Brisson, D. Ripoche, and M. Deque. 2010. Modeling the impact of thermal adaption of soil microorganisms and crop system on the dynamics of organic matter in a tropical soil under a climate change scenario. Ecological Modelling, 221:2850-2858.
Reference ID: 22957
Notes: H 1.9 #22957e
Abstract: No sensensus currently exits about how climate change should affect the status of soil organic matter (SOM) in the tropics. In this study, we analyse the impact of climate change on the underlying mechanisms controling SOM dynamics in a ferralsol under two contrasting tropical crops: maize (C4 plant) and banana (C3 plant). We model the effect of microbial thermal adaption on carbon (C) mineralisation at the crop system scale and introduce it in the model STICS, which was previously calibrated for the soil-crop systems tested in this study. Microbial thermal adaption modeling is based on a reported theory for thermal acclimation of plant and soil respiration. The climate is simulated from 1950 to 2099 for the tropical humid conditions of Guadeloupe (French Antilles), using the ARPEGE model and the IPCC emission scenario A1B. The model predicts increases of 3.4 .C for air temperature and 1100mmyr.1 for rainfall as a response to an increase of 375ppmfor atmospheric carbon dioxide concentration in the 2090–2099 decade compared with the 1950–1959 decade. The results of the STICS model indicate that the crop affects the response of SOM to climate change by controlling the change in several variables involved in C dynamics: C input, soil temperature and soil moisture. SOM content varies little until 2020, and then it decreases faster for maize than for banana. The decrease is weakened under the hypothesis of thermal adaptation, and this effect is greater for maize (.180 kg C ha.1 yr.1 without adaptation and .140 kg C ha.1 yr.1 with adaptation) than for banana (.60 kg C ha.1 yr.1 and .40 kg C ha.1 yr.1, respectively). The greater SOM loss in maize is mainly due to the negative effect of warming on maize growth decreasing C input from residues. Climate change has a small effect on banana growth, and SOM loss is linked to its effect on C mineralisation. For both crops, annual C mineralisation increases until 2040, and then it decreases continuously. Thermal adaptation reduces the initial increase in mineralisation, but its effect is lower on the final decrease, which is mainly controlled by substrate limitation. No stabilisation in SOM status is attained at the end of the analysed period because C mineralisation is always greater than C input. Model predictions indicate that microbial thermal adaptation modifies, but does not fundamentally change the temporal pattern of SOM dynamics. The vegetation type (C3 or C4) plays a major role in SOM dynamics in this tropical soil because of the different impact of climate change on crop growth and then on C inputs.

Ortiz R. and R. Swennen. 2013. From crossbredding to biotechnology-facilitated improvement of banana and plantain. biotechnology advances, 32:158-169.
Reference ID: 22958
Notes: H 2.1.3 #22958e
Abstract: The annual harvest of banana and plantain (Musa spp.) is approximately 145 million tons worldwide. About 85% of this global production comes from small plots and kitchen or backyard gardens from the developingworld, and only 15% goes to the export trade. Musa acuminata and Musa balbisiana are the ancestors of several hundreds of parthenocarpic. Musa diploid and polyploid cultivars, which show multiple origins through inter- and intra-specific hybridizations from these two wild diploid species. Generating hybrids combining host plant resistance to pathogens and pests, short growth cycles and height, high fruit yield, parthenocarpy, and desired quality from the cultivars remains a challenge for Musa crossbreeding, which started about one century ago in Trinidad. The success of Musa crossbreeding depends on the production of true hybrid seeds in a crop known for its high levels of female sterility, particularly among polyploid cultivars. All banana export cultivars grown today are, however, selections from somatic mutants of the group Cavendish and have a very narrow genetic base, while smallholders in sub-Saharan Africa, tropical Asia and Latin America use some bred-hybrids (mostly cooking types). Musa improvement goals need to shift to address emerging threats because of the changing climate. Innovative cell and molecular biology tools have the potential to enhance the pace and efficiency of genetic improvement in Musa. Micropropagation has been successful for high throughput of clean plantingmaterials while in vitro seed germination assists in obtaining seedlings after inter-specific and across ploidy hybridization. Flow cytometry protocols are used for checking ploidy among genebank accessions and breeding materials. DNA markers, the genetic maps based on them, and the recent sequencing of the banana genome offer means for gaining more insights in the genetics of the crops and to identifying genes that could lead to accelerating Musa betterment. Likewise, DNA fingerprinting has been useful to characterize Musa diversity. Genetic engineering provides a complementary tool to Musa breeders who can introduce today transgenes that may confer resistance to bacteria, fungi and nematodes, or enhance pro-vitamin A fruit content. In spite of recent advances, the genetic improvement of Musa depends on a few crossbreeding programs (based in Brazil, Cameroon, Côte d'Ivoire, Guadeloupe, Honduras, India, Nigeria, Tanzania and Uganda) or a handful of genetic engineering endeavors (Australia, Belgium, India, Kenya, Malaysia and Uganda). Development investors (namely international aid and philanthropy) should therefore increase their funding to genetically enhance this crop that ranks among the 10-top staple foods of the developing world.

Naveen S. V., G. Y. Shan, I. T. K. Ping, H. R. B. Raghavendran, M. R. Murali, and T. Kamarul. 2014. Unmodified medium chain length polyhydroxyalkanoate (uMCL-PHA) as a thin flim for tissue engineering application - characterization and in vitro biocompatibility. Material Letters, 141:55-58.
Reference ID: 22959
Notes: H 2.1.3 #22959e
Abstract: In the present study, we developed an unmodified/raw Medium chain length –PHA (MCL-PHA) polyhydroxyalkanoate (PHA), natural microbial polyester by using cost-effective saponified palm kernel oil (SPKO) technique. The functional groups, elemental composition, phase purity, water contact angle, and in vitro human-derived mesenchymal stromal cell attachment were examined. FTIR confirmed the presence of functional groups corresponding to alkyl halide, alkyne, hydroxyl group, and alkane

groups, while XRD and EDX results revealed its phase purity and presence of elements such as carbon and oxygen respectively. SEM and confocal microscope analyses revealed that the bio-material supports cell attachment and this was further confirmed through cell viability assay. In conclusion, the characterization and compatibility studies revealed that this novel scaffold could be a potential candidate for possible tissue engineering applications.

Jassogne L., P. J. A. van Asten, I. Wanyama, and P. V. Baret. 2013. Perceptions and outlook on intercropping coffee with banana as an opportunity for smallholder coffee farmers in Uganda. International Journal of Agricultural Sustainability, 11:144-158.
Reference ID: 22960
Notes: S 18 #22960e
Abstract: Coffee and banana are important cash and food crops in Uganda and the surrounding East African highland region. Production is dominated by smallholders that have limited arable land and often coffee and banana are intercropped. No significant research and development efforts have been undertaken over the last few decades on this coffee/banana intercropping system. Because recent studies suggest that this system could be a practice with high benefits to the farmers, we decided to study the perceptions of stakeholders along the coffee value chain starting with farmers. Perception analysis based on open-ended interviews following interview guides revealed that a major limitation for the sustainability of this system was poor soil fertility conditions. Perceptions on the benefits of intercropping differed little among coffee actors; that is, banana intercropping provides additional food and income from smallholders' limited land and helps farmers reduce risks related to drought, pest/disease attacks and coffee price volatility. However, farmers' desire to minimize risks does not match the objective of stakeholders higher up the coffee value chain to maximize coffee production. Furthermore, research by public institutes, both national and international, is primarily organized for single crops and not systems. We conclude that the institutional setting of the coffee sector hampers the promotion of intercropping, despite the benefits for the farmer.

Deka B. C., A. Thirugnanavel, R. K. Patel, A. Nath, and N. Deshmukh. 2012. Horticultural diversity in North-East India and its improvement for value addition. Indian Journal of Agronomy, 72:157-167.
Reference ID: 22961
Notes: 26.3.2 #22961e
Abstract: Northeast India is known for its diverse nature of soil, climate, and topography. This region is rich in diversity of many fruits, vegetables, flowers particularly orchids, spices, bamboo and medicinal & aromatic plants. Among the commercial fruits of the country, maximum diversity in citrus, banana and jack fruit are found in Northeast India. A large number of diversity in other tropical and subtropical fruits belonging to the genera Garcinia, Artocarpus, Phyllanthus, Annona, Averrhoa, Persia, Aegle, Passiflora and Tamarindus etc. are reported from the region. Northeast India is also rich in different genotypes of cucurbits, solanaceous vegetables, ginger, turmeric, bamboo, leafy vegetables etc. Among the different ornamental horticultural crops, the region has the maximum diversity in orchids, fern and other flowering shrubs. Indigenous and minor horticultural crops available in the region are however not being exploited properly. These crops have the potentiality to alleviate the poverty, food and nutritional insecurity through processing and value addition. Most of these crops are rich in vitamins, minerals and such other bioactive molecules suitable for medicine, aromatic and food processing industries. Protocols for preparation of instant

ginger candy; minimally processed ready-to-cook jack fruit; jam-jelly, fermented and non fermented beverages from different indigenous fruits and tuity fruity from chow-chow have already been standardized. These value added products if produced commercially will go a long way in increasing the area under these crops and thereby enhancing farm income and nutritional security of the farmers.

Chiavatamaset P., P. Sricharoon, S. Tia, and B. Bilitewski. 2014. The characteristics of Bed agglomeration/Defluidization in Fluidized bed firing Palm fruit bunch and Rice straw. Applied Thermal Engineering, 70:737-747.
Reference ID: 22962
Notes: 8.1.1 #22962e
Abstract: The behaviors of bed particle agglomeration and defluidization were investigated during the combustion of oil palm bunch and rice straw in a laboratory scale bubbling fluidized bed reactor. The study focused on (1) the effects of fuel inorganic properties and operating variables on the bed agglomeration tendency and (2) the elucidation in the behaviors of fuel inorganic elements and the governing mode of the agglomeration. It was experimentally found that the defluidization caused by the bed agglomeration was clearly detectable from the decrease of measured bed pressure. The accumulation and growth of the agglomerates provided the partial to complete defluidization. The fuel inorganic composition was the significant influence on the bed agglomeration. The combustion of palm bunch showed higher in the bed agglomeration tendency than the straw combustion in every experimental condition. The defluidization was accelerated in response to the increase in bed temperature and bed particle size, and the decrease of air velocity and static bed height. In the SEM/EDS analysis, the agglomeration was attributed to the formation of the molten substance rich in silicon and fuel derived potassium, likely the potassium silicate compounds, which presented as the adhesive coating and bonding layer. The filling of irregularity on the bed particle surface by the liquid material to form the adhesive layer was dominated by the collision with burning fuel particles. The propagation/reaction inward the bed particles by some reactive constituents was found. The thermodynamic analysis on the ternary phase diagram corroborated that the formation of the liquid material derived from the fuel inorganic elements controlled the agglomeration; the large melt fraction in the adhesive materials at the observed bed temperature range (62–99%) was estimated.

Ramos-Hernandez S. G. and D. Flores-Roman. 2008. Comparison of two phosphate fertilizers in volcanic soils cultivated with coffee, of Soconusco, Chiapas, Mexico. Agrociencia, 42:391-398.
Reference ID: 22963
Notes: 22.2 #22963e
Abstract: Volcanic soils of several coffee-producing regions of Soconusco, Chiapas, México, classified as Andisols, have peculiar physical and chemical characteristics and a udic moisture regime. The objective of this study was to evaluate the function of phosphorus and phosphorus-related problems in the cultivation of coffee (Coffea arabica). Physical and chemical properties of the volcanic ash soils under a representative coffee plantation were determined. Two sources of phosphate fertilizers (triple superphosphate, ST; rock phosphate, RF) were compared. Phosphorus content in soil and plant was assessed, as well as its effect in four seasons of the year over five years. Besides, the residual effect of the phosphate sources and the effect of organic fertilizer on phosphorus contents of soil and plant was compared. The commercial formula (18-12-06) and two controls (18-00-12 and

00-00-00) were used. The study was conducted in the Municipality of Unión Juárez, Chiapas, México. An analysis of variance was performed with the data, and means were compared with the Tukey test. A high level of P fixation in the soil was found. The highest concentrations of P in the soil and coffee plant were obtained with 18-20-12 RF and 18-20-12 ST. The highest concentrations of P were observed in June and September. There was better P residuality in the soil with RF than with ST, while with organic fertilizer there was no satisfactory response.

Redhead A., G. Gouveia, and G. Eudoxie. 2006. Case study on estimating soil erosion and potential water pollution in the Caura Valley watershed of Trinidad. Page 1 Caribbean Food Crops Society.
Reference ID: 22964
Notes: #22964e
(Abstract only) in Caribbean Food Crops Society 42nd Annual Meeting 2006 at Carolina, Puerto Rico
Abstract: Erosion is among the most critical global environmental hazards. Quantitative data on the rate of soil erosion in Trinidad and Tobago is very limited are reliability is a major problem. Eroded material with nitrogen phosphorous adsorbed to the particles can cause severe pollution in the form of eutrophication and sedimentation of the Caura River. The northernmost part of the watershed has been a major vegetable production area for decades with many farmers engaged in year-round intensive production on the gently and moderately sloping terrain just on the banks of the main river. The main objective of this study was to develop an erosion index for farmers to quantidy erosion occuring on their farms based on land use and other management characteristics. The establishment of nine erosion plots on active production sites and on control non-production sites took place in the rainy season of 2005 between the months of September and October. These plots were placed on slope categories 0 to 5%, 5 to 10% to 17%. Runoff from each plot was collected and tested for levels of phosphorous, nitrogen and total suspended solids. The control non-production sites (10 to 17% slope) contained the highest values for total suspended solids. The active production sites (0 to 5% slope) contined the highest amounts of nitrogen and phosphorous. It is important to note, however, that as runoff increased, the quality of nitrogen increased but phosphorous remained relatively constant. Details of the index developed will be presented.

Fleming, K., Smith, V. E., and Bitternbender, H. C. The Economics of Cacao Production in Kona. Agricultural Business, 1-12. 2009. UH–CTAHR.
Reference ID: 22965
Notes: H 8.1.4 #22965e
Abstract: This study uses an interactive spreadsheet model to estimate the economic costs and returns for producing cacao in Kona. The price and production data are typical for a 1-acre, mature cacao orchard in 2009; however, the economic model is flexible enough to accommodate a wide range of production systems with different cost structures and sizes of operation. In Kona, primary market demand is for wet beans. Two wet-bean costs and returns scenarios (one producing 100% Forastero and the other 100% Criollo) were selected for this publication, but the underlying computer model allows for many other production scenarios to be developed, such as any mix of cacao varieties sold in any combination of wet-bean, dry-bean, pod, and other cacao-related items. (Cacao dry-bean, pod, and by-product sales are converted into wet-bean equivalents to better evaluate comparative profitability of various cacao enterprises.) Given the relatively small size of the market for cacao in Kona, a purely

competitive, market-based price for cacao wet beans cannot currently be generated by market forces alone. The primary purpose of this economic analysis is to enable Hawai'i's cacao growers and processors todetermine a price for wet cacao beans that will be fair to both farmer and cacao processor, allowing both enterprises to be profitable in the long run. A fair price will ensure the sustainability of local cacao production and processing.

Atanda O. A. and V. J. Jacob. 1973. Comparative field-pod value of west African Amelonado and amazon cacao in Nigeria. Ghana Journal Of Science, 13:1-6.
Reference ID: 22966
Notes: H 8.1.4 #22966e
Abstract: Pod value, the amount of dry peeled beans obtained per pod and its attributes were investigated in open-pollinated West African Amelonado and bulk F2 Amazon Cacao at their peak values for fourteen weeks at weekly intervals between October 1968 and January 1969 in order to compare their pod value potentials under field conditions. The results showed that West African Amelonado was superior to bulk F2 Amazon in all the factors considered namely number of beans per pod, mean dry peeled bean weight. wet to dry peeled bean weight conversion rate, pod value, efficiency of dry bean production and low percentage seed C0at. These observed superiorities were significant except for mean dry peeled bean weight. The calculated pod value and the percentage seed coat were however. only just significant at P = 0.1. The effect of days of harvests was not significant on all the factors considered. It is concluded that the estimated higher pod value of Amelonado was mostly due to the greater number of beans per pod. Effect of self-compatibility on the number of beans per pod is discussed in relation to pod value. It is suggested that the desirable and superior pod value traits in Amelonado particularly its high number of beans per pod should be bred into newer cacao cultivars with a view to stepping up the pod value.

ISP. The Planter Vol 92 No 1084 July 2016. [92], 437-508. 2016. Kuala Lumpur, ISP.
Reference ID: 22967
Notes: S serial #22967
In this issue:
Article: Harnessing Rainwater: Ladang Perlating Jerneh's Experience **#22968**
Reproduced: Zero Waste Management - Sime Darby Plantation's Experiences **#22969**

Abd Majid R., K. Kumar, and M. Z. Yusof. 2016. Harnessing Rainwater: Ladang Perlating Jerneh's Experience. The Planter, 92:445-460.
Reference ID: 22968
Notes: #22968 > S serial #22967
Abstract: Any prolonged dry weather will have a big adverse impact on the crop production in the oil palm plantations for up to twelve to eighteen months. Ladang Perlating Jerneh, located in Bahau, Negeri Sembilan is in a rain-shadow area. Besides the El Nino, this estate also suffers from two other inherent limitations i.e. lower annual rainfall (averaging only 1780 mm/year for the last 10 years) and poor soils (mainly Batu Anam, Durian and Malacca Series). The approaches implemented since 2013 to mittigate the limitations included the construction of humps and sumps, silt pits, conservation terrances and frond stacking. Most recently utilisation of Ganoderma pits and planting on platforms in the entire 2015/16 replanting was implemented. The hump and sump technique was introduced in 2013 in the 2008 replanting.

Tang M. K., V. N. Shylaja, and N. Iswari. 2016. Zero Waste Management - Sime Darby Plantation's Experiences. The Planter, 92:461-468.
Reference ID: 22969
Notes: #22969 > S serial #22967
Reproduced from the 12th ISP National Seminar 2016 book, "Factors Impacting the Competitiveness of the Palm Oil Industry".
Abstract: Sime Darby Plantation is one of the oldest and largest palm oil producers in the world. Its pioneering spirit and inventiveness has led to many breakthroughs and palm oil industry-firsts, setting the standard in argricultural and operational best practices. Today, it is also an industry leader in promoting sustainable plantation practices worldwide, being the world's largest certified sustainable palm oil producer. In addition to being a leader in sustainable palm oild production, Sime Darby Plantation also has a heavy focus on climate change.

ISP. The Planter Vol 92 No 1085 August 2016. [92], 517-590. 2016.
Reference ID: 22970
Notes: S serial #22970
Article: Minimising the Haze **#22971**
Reproduced: Water Footprint Analysis of oil palm planted in Malaysia **#22973**

Paramananthan S. 2016. Minimizing The Haze. The Planter, 92:523-548.
Reference ID: 22971
Notes: #22971 > S serial #22970
Abstract: The haze is becoming on annual problem in Sountheast Asia. The degree and intensity of the fires and the haze was exceptionally bad in 2015. The haze has affected the health of many people causing eye irritating and respiratory illness. It is reported that food and poultry production had been seriously affected in Malaysia - what more in Indonesia and Singapore? The blame of course goes to Indonesia where the slash and burn system practiced by the small farmers had caused the fires to spread to most parts of Indonesia. The blame game is in full swing with the non-governmental organisations (NGOs) mainly blaming the oil palm, rubber and acacia platations on peatlands for the haze. The Singapore Government is using its current laws to charge its plantations owners in Indonesia. Due to changes in wind directions, the haze has reached South Thailand and the Philippines. Offers of help to put out the blazing forests comes not only from Indonesia's Association of Southeast Asian Nations (ASEAN) neighbours but also from the United States and Russia.

Hashim Z., A. A. Murdi, and Z. Yahya. 2016. Water Footprint Analysis of Oil Palm Planted in Malaysia. The Planter, 92:549-564.
Reference ID: 22973
Notes: #22973e > S serial 22970
Reproduced from the 12th ISP National Seminar 2016 Book, "Factors Impacting The Competitiveness of the Palm Oil Industry".
Abstract: Oil palm (Elaeis guineensis) is one of the most rapidly expanding crops in the tropics. Environmental concerns about deforestation and greehouse gas emissions and of late, wate shortage or scarcity are the main threats to life on our planet. Water is one of the most important factors affecting the groth and production of oil palm. In Malaysia, the oil palm which is rainfed, depans entirely on rainfall for its water requirements.

Sustainable Cocoa Fund Study. 1-27. 2011. KPMG.
Reference ID: 22975
Notes: H 8.1.4 #22975e
Abstract: This report is exclusively drawn up for thee purpose of a cost/benefit analysis of the certification of West-African cocoa farmers commissioned by the Stiching IDH sustainable trade initiative (IDH) and for no other purposes. KPMG Advisory N.V.("KPMG") does not guaranteeor declare that the information in the report is suited for the objectives of others than IDH. This means that our report cannot replace other than IDH may (or should) initiate with the objective to obtain adequate information about matters that are of interest to them. It is not the responsibility of KPMG to provide information to any thrid party that has become known or available at any time after the date of the report.

Hutz-Adams, F. and Fountain, A. C. Cocoa Barometer 2012. 1-28. 2016. Cocoa Barometer.
Reference ID: 22976
Notes: H 8.1.4 #22976
Abstract: The Cocoa Barometer 2012 is an endeavour to stilmulate and enable stakeholders to communicate and discuss critical issues. This Barometer aims to provide an overview of current sustainability developments in the cocoa sector. The authors have chosen to focus on West Africa's cocoa sector, due to its dominance in cocoa production and the significant challenges facing this region. Becuause of the constraints of this publication and the absence of third party evaluations, focus on individual company projects and evaluations of Standards Bodies is not a key element of the current Barometer, but there are plans for these topics to become the core foucus of the Cocoa Barometer 2013.

IPNI. Better Crops With Plant Food. Better Crops With Plant Food 99[3], 1-23. 2015. USA, IPNI.
Reference ID: 22977
Notes: S serial #22977
In this issue:
Nitrogen management in illinois intensifies as state implements nutrient loss reduction strategy **#22978**
Co-granulated elemental sulfur/sulfate fertilizers and their role in crop nutrition **#22979**
Sulfur nutrition of oil palm in Indonesia - The Neglected Macronutrient **#22980**
Coffee-Forage intercropping is a sustainable production system for Brazil **#22981**
Precision Nutrient management in No-till wheat: A case study for Haryana **#22982**
Nutrient expert - Going glabal with improved fertilizer recommendations **#22983**

Payne J. and E. Nafziger. 2015. Nitrogen management in illinois intensifies as state implements nutrient loss reduction strategy. Better Crops With Plant Food, 99:4-6.
Reference ID: 22978
Notes: #22978e > S serial #22977e
Abstract: A N management program named N-WATCH™ is helping farmers and regulators track changes in soil N concentrations during the year. This on-farm research is leading to better management decisions and improved engagement with policy makers.

McLaughlin M. J., F. Degryse, R. C. da Silva, and R. Baird. 2015. Co-granulated elemental sulfur/sulfate fertilizers and their role in crop nutrition. Better Crops With Plant Food, 99:7-10.
Reference ID: 22979
Notes: #22979e > S serial #22977e
Abstract: The effectiveness of S-enhanced ammoniated phosphate fertilizers, with both fast and slow release forms of S, differs based on the growing environment. The presence of elemental S can be advantageous in environments at risk for leaching of sulfate. Sulfate-S performs best in environments with less risk of loss, but products co-granulated with a suitable size of elemental S can be equally effective.

Gerendas J., C. Donough, T. Oberthür, Rahmadsyah, G. Abdurrohim, K. Indrasuara, A. Lubis, T. Dolong, and M. Fisher. 2015. Sulfur nutrition of oil palm in Indonesia - The Neglected Macronutrient. Better Crops With Plant Food, 99:11-13.
Reference ID: 22980
Notes: #22980e > S serial #22977e
Abstract: Little attention has been paid to the S nutrition of oil palm, despite a trend towards using fertilizers that contain no S. Data show S concentrations can be far below the established critical value of 0.20%. The established critical S concentration should be reduced to 0.15% based on a critical N concentration of 2.3% and an S:N ratio of 15.

Favarin J. L., T. Tezotto, W. Pedrosa, and P. Neto. 2015. Coffee-Forage intercropping is a sustainable production system for Brazil. Better Crops With Plant Food, 99:16-17.
Reference ID: 22981
Notes: #22981e > S serial #22977e
Abstract: Cover crop forage grown under the coffee plant canopy serves as an important biomass source, which is proving effective at protecting this agro-ecosystem while improving the use of N.

Sapkota T. B., K. Majumdar, and M. L. Jat. 2015. Precision Nutrient management in No-till wheat: A case study for Haryana. Better Crops With Plant Food, 99:18-19.
Reference ID: 22982
Notes: #22982e > S serial #22977e
Abstract: Poor understanding of nutrient management in no-tillage-based wheat spurred a comparison of various available strategies. The greatest overall benefit was generated with Nutrient Expert®-based fertilizer recommendations supplemented with GreenSeeker®-guided N application.

Johnston A. 2015. Nutrient expert - Going Global with improved fertilizer recommendations. Better Crops With Plant Food, 99:20.
Reference ID: 22983
Notes: #22983e > S serial #22977e
Abstract: Eight years of software development has grown both the confidence and understanding of how Nutrient Expert® can help meet the needs of small farmers.

Alonso-Ayuso M., J. L. Gabriel, and M. Quemada. 2016. Nitrogen use efficiency and residual effect of fertilizers with nitrification inhibitors. European Journal of Agronomy, 80:1-8.
Reference ID: 22984
Notes: #22984e

Abstract: Blending fertilizers with nitrification inhibitors (NI) is a technology to reduce nitrogen (N) losses. The application of NI could increase the soil N supply capacity over time and contribute to an enhancement of N use efficiency (NUE) in some cropping systems. The objectives were to determine in a field experiment located in Central Spain (i) the effect of NI-fertilizers applied to maize.

Bruulsema T. 2016. The Colors in Phosphorus Deficient Plants. Better Crops With Plant Food, 100:14-16.
Reference ID: 22985
Notes: #22985e > S serial #22259e
Abstract: Purple or red coloring sometimes indicates P deficiency for some plant species; however, colored leaf margins seem to serve a wide variety of functions in plant acclimation to environmental stress. Examining the physiology and biochemistry of pigment production explains some of the variable color responses. It also highlights the role of P in photosynthetic energy transfer, a role crucial to high-yield crop production systems.

Kumar R., S. Karmakar, A. K. Sarkar, S. Dutta, K. Majumdar, T. Satyanarayana, and M. A. Jonston. 2016. Importance of Phosphorus Management in Maize-Wheat Cropping Systems. Better Crops With Plant Food, 100:17-19.
Reference ID: 22986
Notes: #22986e > S serial #22259e
Abstract: Omission of phosphate fertilizer reduced cropping system productivity, showing the importance of balanced P application in the relatively low fertility red and lateritic soils of Jharkhand.

Njoroge S. and S. Zingore. 2015. 4R Practices for Efficient Phosphorus Management in Western Kenya. Better Crops With Plant Food, 99:7-9.
Reference ID: 22987
Notes: #22987e > S serial 21858e
Abstract: On-farm research evaluating 4R Nutrient Stewardship found source, rate, timing, and placement of P fertilizers can be managed to increase productivity, profi tability and P use efficiency for smallholder farmers.

Mikkelsen R. 2015. Phosphorus Management for Potatoes. Better Crops With Plant Food, 99:10-11.
Reference ID: 22988
Notes: #22988e > S serial #21858
Abstract: Economic rates of P fertilization are higher for potatoes than for many other crops due to shallow roots and sparse root hairs. BMPs are outlined to minimize the risk of P losses from potato fields.

Daoui K., R. Karrou, R. Mrabet, Z. Fatemi, and K. Oufdou. 2015. Faba Bean Fertilization in Morocco. Better Crops With Plant Food, 99:12-13.
Reference ID: 22989
Notes: #22989e > S serial #21858e
Abstract: Faba bean represents one of the important annual food crops grown in Morocco.
Research is showing that fertilizer, mainly P, management can contribute significantly to the increase of faba bean yields.

Yao L., G. Li, and S. Tu. 2015. 4R Nutrient Management for Banana in China. Better Crops With Plant Food, 99:17-19.
Reference ID: 22990
Notes: #22990e > S serial #21858e
Abstract: A review organized within the 4R Nutrient Stewardship framework demonstrates yield and quality boosting practices for banana grown within southern China.

Neuhaus A., J. Easton, and C. Walker. 2015. Phosphorus Requirements for Cereals: What Role Does Crop Rotation Play? Better Crops With Plant Food, 99:20-22.
Reference ID: 22991
Notes: #22991e > S serial #21858e
Abstract: A network of field data refines critical soil test values for cereals based on the interaction between previous crop and soil P immobilization.

Zuiderma, P. A., Leffelaar, P. A., Gerritsma, W., Mommer, L., and Anten, N. P. R. The First Physiological Production Model for Cocoa (Theobroma cacao): model presentation, validation and application. 2005.
Reference ID: 22992
Notes: H 8.1.4 #22992
Published work under different title #21784 A physiologcal production model for cocoa
Abstract: In spite of the economic importance and extensive agronomic literature on cocoa, no physiological production model has been developed for cocoa so far. Such a model would be very useful to compare yields in different climates and cropping systems, and to set the agenda for future agronomic research. Here, we present and apply such a physiological growth and production model for cocoa (SUCROS-Cocoa), based on the SUCROS-family of physiological crop growth models. Our model calculates light interception, photosynthesis, maintenance respiration, evapotranspiration, biomass production and bean yield for cocoa trees grown under shade trees. It can cope with both potential and water-limited situations, and is parameterised using existing information on cocoa physiology and morphology. A validation study showed that the model produces realistic output for bean yield, standing biomass, leaf area and size-age relations. Simulations were carried out using climatic information of 30 locations in 10 cocoa-producing countries, three different soil types and varying shade levels.
The model was applied to answer four questions that are currently relevant to cocoa production. (1) Which are the most important yield-determining parameters? Sensitivity analyses revealed that these parameters were chiefly related to the morphology of fruits, photosynthesis and maintenance respiration. (2) To what extent can cocoa yield be predicted by rainfall and irradiance data? Regression analyses showed that over 70% of the variation in simulated bean yield could be explained by a combination of annual radiation and rainfall during the two driest months. (3) How large is the cocoa yield gap due to water limitation? Yield gaps were large - up to 50% - for locations with a strong dry season combined with an unfavourable (clayey or sandy) soil. The calculated yield gaps decreased exponentially with the amount of rain during the two driest months. (4) What are the consequences of shading on cocoa yield? Our simulations showed that moderate shade levels hardly affected bean yield, whereas heavy shading (>60%) reduced yields by more than one-third.

AusAID. Cocoa Processing Methods for the Production of High Quality Cocoa in Vietnam. 1-18. 2016. Australian Govt.
Reference ID: 22993
Notes: H 8.1.4 #22993e

Milder, J. C. and Newsom, D. 2015 SAN/Rainforest Alliance Impacts Report: Evaluating the Effects of the SAN/Rainforest Alliance: Certification System on Farms, People, and the Environment. 1-124. 2015. SAN/Rainforest Alliance.
Reference ID: 22994
Notes: S 13 #22994e
Abstract: In 1992, two banana farms first attained Rainforest Alliance certification, heralding the start of a brave experiment in linking producers, consumers and private companies to drive a transition to sustainable agriculture. By the mid-2000s, our certification program had grown into a solid niche for bananas, coffee and several other crops. The past five years, however, have been our most exciting chapter yet, witnessing rapid growth in the marketplace and deep engagement with hundreds of thousands of producers across the tropics and sub-tropics through field training and support.
With this report.our first-ever system-wide synthesis of impacts.we pause to evaluate the effects of Sustainable Agriculture Network (SAN)/Rainforest Alliance certification relative to the goals we share with our participating producers, companies and partners. These goals include conserving biodiversity, safeguarding natural resources, increasing farm productivity and profitability and improving the lives of farmers, workers and their families.
The results shared here provide strong evidence that SAN/Rainforest Alliance certification is driving social and environmental sustainability on farms and in rural communities, landscapes and watersheds. In our own data, we see that certified producers are progressively adopting more sustainable practices related to soil health, fertilizer use, water management, waste management, and workers's rights and well-being. And from independent research we learn that these practices, in turn, are contributing to more productive farms, higher incomes, better-educated children, cleaner streams, more native flora and fauna, and a host of other benefits. As exciting as it is to see the benefits of the SAN/Rainforest Alliance certification program corroborated by solid evidence, for us this report has an additional and even greater purpose: it helps us pinpoint areas for improvement and understand how we can work with our producers and partners to be even more effective in the future. Evaluation and learning is a continuous process for the SAN and the Rainforest Alliance, and it guides us in the ongoing development of our field programs and in the periodic revision of our standard.the next version of which is due soon.
We continue to see certification not as an end in itself, but as a catalyst for bringing about a world in which sustainable agriculture is the norm. Please join us in making this vision a reality.

Santiago H. L. and W. I. Lugo. 2006. Food Safety and Value Added Production and Marketing in Tropical Crops. Pages 1-459 Caribbean Food Crops Society.
Reference ID: 22995
Notes: #22995e Caribbean Food Crops Society 42nd Annual Meeting 2006 July 9-15 2006 Intercontinental Hotel, Carolina, Puerto Rico
Contents:
Case Study on Estimating Soil Erosion and Potential Water Pollution in the Caura Valley watershed of Trinidad **#22964**

Estimation of short-term actual crop evapotranspiration
Turfgrass establisment, maintenance and management in stress situations in Trinidad and Tobago
Clay and organic matter effects on splash detachment
Harnessing the potential of native herbaceous legume germplasm
Structural analysis and species composition of tree species associated with coffee in Puerto Rico
The relationship between soil properties and soil behaviour in response to management for agricultural and sporting applications
Prediction sediment and nutrient loafs in tropical watersheds in Puerto Rico
Bacteria associated to the rhizosphere of plants growing on eroded soils
Minimum tillage technologies for the establishment of Brachiaria decumbens on the northwestern coastal plains of Puerto Rico

Sivaraman K., K. Kandiannan, K. V. Peter, and C. K. Thankamani. 1999. Agronomy of black pepper (*Piper nigrum* L.) - a review. Journal of Spices and Aromatic Crops, 8:1-18.
Reference ID: 22996
Notes: #22996e
Abstract: Black pepper (Piper nigrum L.), a highly valued spice crop, is a perennial vine which originated in the Western Ghats of India and subsequently spread to other countries. Various aspects of crop ecology and agronomical practices such as planting material production, spacing and supports, training and pruning, irrigation, mulching and weeding, nutrition, harvest and cropping systems are reviewed.

Havilah E., H. Warren, R. Lawrie, A. Senn, and P. Milham 2005. Fertilisers for Pastures, NSW DPI, New South Wales.
Reference ID: 22997
Notes: #22997e
Abstract: This booklet is a guide to help landholders make better fertiliser decisions for their pastures. Much of the information comes from a major grazing project on the Camden district dairy farm at Elizabeth Macarthur Agricultural Institute. The findings have been combined with results from other fertiliser trials. The information targets the higher rainfall (over 750 mm) districts of eastern NSW, grazing mostly beef cattle, dairy cattle or horses under relatively high stocking rates. It is also suitable for farmers grazing goats, sheep, alpaca and donkeys. The pastures in this region are generally rainfed with some properties using supplementary irrigation.
In this zone, many of the soils are weathered and low in nutrients. The soils may have other features that also limit pasture growth eg shallow depth, acidity and salinity. An assessment of these factors is a necessary part of making better fertiliser decisions. The need for fertilisers is closely related to the intensity of production. Dairy farms require high inputs due to high grazing intensity and continuous product removal. On the other hand, pastures grazed at lower stocking rates such as a beef breeding enterprise or horses, have a much lower need for fertilisers.
A very wide range of products is available, from conventional, factory-made fertilisers to the raw, organic alternatives derived from animal manure or food processing wastes. Some products contain a mixture of both materials. This book covers the basics of soil testing and outlines the effect of acidity, salinity and sodicity on soil fertility. There is information on individual nutrients, cation exchange capacity, trace minerals and nutrient budgets. There are sections on using organic materials as

fertilisers, on how to use plant and animal symptoms to detect nutrient disorders and on animal health issues involving fertiliser.

IPNI. Plant Nutrition Today - Fall 2016 no 6: What did fertilizer do for us today? 1-2. 2016. USA.
Reference ID: 22998
Notes: #22998e
Abstract: TODAY is Global Fertilizer Day. One day set aside to acknowledge fertilizer's every day contributions. Fertilizer is a primary source of plant nutrition. As a result, fertilizer's role in sustaining crop production is essential to providing our daily nutritional needs. Our farmers' ability to feed 7.5 billion people each day is impressive, but in some areas of the world this doesn't actually happen. Where ever soil fertility is lacking, farmers confront a failure to provide an abundant and nutritious food supply. Responsible use of fertilizer accomplishes this feat in an environmentally sound and economically viable manner.

IPNI and Mikkelsen, R. Plant Nutrition Today - Fall 2016 no 7: All Plant Nutrients Interact. 1-2. 2016. USA.
Reference ID: 22999
Notes: #22999e
Abstract: At the core of most successful crop production is allowing plants to reach their full photosynthetic potential. This simple objective is complicated by hundreds of factors, some controllable and others subject to the whims of nature.

Hoffman M. P., C. R. Donough, S. E. Cook, M. J. Fisher, C. H. Lim, Y. L. Lim, J. Cock, S. N. Mohanaraj, K. Indrasuara, P. Tittinutchanon, and T. Oberthür. 2017. Yield gap analysis in oil palm: Framework development and application in commercial operations in Southeast Asia. Agricultural Systems, 151:12-19.
Reference ID: 23000
Notes: #23000e
Abstract: Narrowing the gap between actual and attainable yields in existing oil palm plantations is perceived as a key to fulfill the growing global demand for vegetable oil. To assess the scope for intensification we need robust estimates of attainable yields, which has been so far rarely done for perennial crops. For this purpose, we evaluated the complexities associated with estimating yield gaps (YGs) in oil palm (i.e. carry-over effect and aging), and adapted the existing framework for YG studies in annual crops. Based on this framework, we analyzed YGs for four sites within oil palm plantations located in Sabah (Malaysia), Central Kalimantan and North Sumatra (Indonesia) using a unique commercial yield data set covering an area of 38,300 ha. We assessed for each site at plantation scale water-limited potential yield using the PALMSIM simulation model, attainable yield determined by best performing blockswithin the plantation as defined by 90th percentile of observed yields and actual yields (blocks representing the median yields). The water-limited potential yield did not differ very much; 35-39 t fresh fruit bunch (FFB) during the plateau phase, the most productive phase in the life timeof a palm. This reflected the favorable environmental conditions found in many parts of Sumatra and Borneo for oil palm. Attainable yields were in the range of 26-31 t FFB/ha. The exploitable YG between attainable and actual yield ranged for the four sites from 5 to 7 t FFB/ha/year. For one site (Central Kalimantan), we assessed yield variability due to varying soil conditions at the block scale according to its dominant soil type. This suggested that they were indeed exploitable by management. If the plantation could close the gap between attainable

and actual yield this could give about 21,000 t/yr higher FFB. This indicated the large scope for intensification oil palm offers in many parts of insular Southeast Asia.

Yin F. and G. Zhou. 2015. Residual Potassium Effects on Corn under No-Tillage. Better Crops With Plant Food, 99:23-25.
Reference ID: 23001
Notes: #23001e > S serial #21858e
Abstract: The residual eff ects of long-term surface broadcasting of K fertilizer to preceding cotton provided sufficient K to three successive no-till corn crops.

Kirillova G. B. and G. M. Yusupova. 2015. Nutrient Management in Spring Rapeseed-based Systems in the Southern Ural Region. Better Crops With Plant Food, 99:26-27.
Reference ID: 23002
Notes: #23002e > S serial #21858e
Abstract: Fertilizer use in the southern Ural region of Russia is inadequate to support attainable yield goals. Improved nutrient management systems readily achieved 80 to 86% of set yield goals for spring rapeseed.

C & CI. C&CI: Coffee and Cocoa International November 2016. Coffee & Cocoa International 43[5], 1-50. 2016.
Reference ID: 23003
Notes: S serial #23003

IPNI. Better Crops with Plant food Vol.100 (2016, no.4). Better Crops With Plant Food 100[4], 1-31. 2016. IPNI.
Reference ID: 23004
Notes: S serial #23004e
In this Issue:
Testing the Benefits of Balanced Nutrient Use and Crop Diversification on Soil Productivity and Health **#23005**
Using Plant Physiology to Diagnose Nitrogen Deficiency in Wheat **#23006**
Adapting Oil Palm Best Management Practices to Ghana: Opportunities for Production Intensification **#23007**
Nutrient Use Efficiency in Oil Palm Nurseries **#23008**
Controlled-Release Urea in Banana Production in Southern China **#23009**

Dyek M., D. Puurveen, and T. Jensen. 2016. Testing the Benefits of Balanced Nutrient Use and Crop Diversification on Soil Productivity and Health. Better Crops With Plant Food, 100:7-9.
Reference ID: 23005
Notes: #23005 > S serial #23004e
Abstract: A long-term crop rotation study in the Northern Great Plains of Canada helps our understanding of the interactions between crop rotation and nutrient management.

Neuhaus A., M. Hoogmoed, and V. Sadras. 2016. Using Plant Physiology to Diagnose Nitrogen Deficiency in Wheat. Better Crops With Plant Food, 100:10-11.
Reference ID: 23006
Notes: #23006e > S serial #23004e
Abstract: A nitrogen nutrition index (NNI) is presented as a robust interpretation method to guide profitable and sustainable in season N applications in dry climates

with unfertile soils.Risk management and improved confidence in diagnosing early N deficiency is the focus of this research.

Rhebergen T., T. Fairhurst, S. Zingore, M. Fisher, T. Oberthür, and A. Whitbread. 2016. Adapting Oil Palm Best Management Practices to Ghana: Opportunities for Production Intensification. Better Crops With Plant Food, 100:12-15.
Reference ID: 23007
Notes: #23007e > S serial #23004e
Abstract: An increasing global demand for palm oil, and limited availability of agricultural land in Southeast Asia, has driven a rapid expansion of new oil palm plantings in West Africa.
Sub-optimal climate conditions and generally low yields in West Africa, combined with highly fragmented land holdings limit the potential for expansion of large-scale plantings.
Research conducted in Ghana indicates that production increases can alternatively be sought by applying best management practices to land already planted with oil palm.

Sugianto H., C. Donough, Rahmadsyah, C. H. Lim, and T. Oberthür. 2016. Nutrient Use Efficiency in Oil Palm Nurseries. Better Crops With Plant Food, 100:16-18.
Reference ID: 23008
Notes: #23008e > S serial #23004e
Abstract: Soil tests are useful in selecting suitable topsoil for use as growth medium in oil palm nurseries to avoid differences in plant growth between sites. Nutrient use efficiency (NUE) in oil palm nurseries can be improved with appropriate application rates and timing. Further improvements in NUE in oil palm nurseries could come with more efficient irrigation and use of slow-release nutrient sources.

Tan H., L. Zhou, Y. Zeng, H. Ou, J. Huang, X. Zhu, and S. Tu. 2016. Controlled-Release Urea in Banana Production in Southern China. Better Crops With Plant Food, 100:19-21.
Reference ID: 23009
Notes: #23009e > S serial #23004e
Abstract: Researchers tested complete or partial substitution of controlled-release urea for regular urea in order to identify new options capable of off ering high fruit yield along with improved efficiencies in crop management and N use.

Mikkelsen R. 2015. Introduction to International Year of Soils Special Issue. Better Crops With Plant Food, 99:1-31.
Reference ID: 23010
Notes: #23010e > S serial #20735e
Abstract: Each of us has a close association with soil each day, but we rarely stop to consider its importance. In fact, if there were no soil, there would be no life on earth! In recognition of the essential role that soils play in sustaining our water, air, and food, the United Nations has declared 2015 to be the International Year of Soils. The importance of soils is central to the mission of the International Plant Nutrition Institute (IPNI), which is to promote responsible management of plant nutrition for the benefit of the human family. Soils and their ability to support adequate agricultural production will play a key role in accomplishing our goal. We are pleased to devote this issue of Better Crops to highlight a few key areas related to the essential role of soil.

Buuren S. V. and K. Groothuis-Oudshoorn. 2011. Multivariate Imputation by Chained Equations in R. Journal of statistical Software, 45:1-67.
Reference ID: 23011
Notes: 16.1 #23011e
Abstract: The R package mice imputes incomplete multivariate data by chained equations. The software mice 1.0 appeared in the year 2000 as an S-PLUS library, and in 2001 as an R package. Mice 1.0 introduced predictor selection, passive imputation and automatic pooling. This article documents mice 2.9, which extends the functionality of mice 1.0 in several ways. In mice 2.9, the analysis of imputed data is made completely general, whereas the range of models under which pooling works is substantially extended. mice 2.9 adds new functionality for imputing multilevel data, automatic predictor selection, data handling, post-processing imputed values, specialized pooling routines, model selection tools, and diagnostic graphs. Imputation of categorical data is improved in order to bypass problems caused by perfect prediction. Special attention is paid to transformations, sum scores, indices and interactions using passive imputation, and to the proper setup of the predictor matrix. Mice 2.9 can be downloaded from the Comprehensive R Archive Network. This article provides a hands-on, stepwise approach to solve applied incomplete data problems.

Ezui, K. S., Franke, A. C., Mando, A., Ahiabor, B. D. K., Tetteh, F. M., Sogbedji, J., Janssen, B. H., and Giller, K. E. Fertiliser requirements for balanced nutrition of cassava across eight locations in West Africa. Field Crop Research, 1-10. 2015. Elsevier.
Reference ID: 23012
Notes: #23012e
Abstract: Insufficient and unbalanced fertiliser use widens cassava yield gaps. We assessed the spatial variability of optimal fertiliser requirements of cassava for enhanced nutrient use efficiency and increased yield using the balanced nutrition approach of the QUEFTS model. Two datasets comprised of five fertiliser experiments conducted at eight locations across Southern Togo, Southern Ghana and Northern Ghana from 2007 to 2012 were used. The ratio of storage roots dry matter yield over the sum of available N, P and K expressed in crop nutrient equivalent from the soil and nutrient inputs was used as a proxy to estimate nutrient use efficiency. Nutrient use efficiencies of 20.5 and 31.7 kg storage roots dry matter per kilo crop nutrient equivalent were achieved at balanced nutrition at harvest index (HI) values of 0.50 and 0.65, respectively. N, P and K supplies of 16.2, 2.7 and 11.5 kg at an HI of 0.50, and 10.5, 1.9 and 8.4 kg at an HI of 0.65 were required to produce 1000 kg of storage roots dry matter. The corresponding optimal NPK supply ratios are 6.0-1.0-4.2 and 5.3-1.0-4.2. Nutrient use efficiencies decreased above yields of 77-93% of the maximum. Evaluation of the performance of blanket fertiliser rates recommended by national research services for cassava production resulted in average benefit:cost ratios of 2.4 ¡¾ 0.9, which will be unattractive to many farmers compared to 3.8 ¡¾ 1.1 for the balanced fertiliser rates. The indigenous soil supply of nutrients revealed that, at balanced nutrition, K was the most limiting nutrient to achieve storage roots yields up to 8 Mg dry matter ha.1 at most sites, whereas N and P were needed at greater yields. Dry weight of storage roots measured on the control plots in our researcher managed experiment ranged from 5.6 to 12.2 Mg ha.1, and were larger than the average weight in farmers' fields in West Africa of 4 Mg ha.1. Substantial yield increase could be attained in the region with improved crop management and fertiliser requirements formulation on the basis of balanced nutrition.

IPNI and Snyder, C. Plant Nutrition Today - Fall 2016 No 2: This is not your father's world of nitrogen management. 1-2. 2016. IPNI.
Reference ID: 23014
Notes: 2.8.1.1 #23014e
Abstract: Many of us older citizens can remember times when our fathers toiled day and night, to coax meager crop yields from fields they owned; land which often had suffered from less thanstellar management by their forefathers. Many current farmers are coping with a legacy of excessive "recreational" soil tillage; and an inheritance of complacency about optimal soil fertility management and appropriate conservation practice implementation. A high percentage of absentee land ownership sometimes makes it difficult for a farmer to focus on more than the land rental check; causing inadequate attention to sustained soil productivity and reduced loss of nitrogen (N) from the soil to water and air resources.

IPNI and Murrell, T. S. Plant Nutrition Today - Fall 2016 No 3: Potassium Fertility In North American Soils. 1-2. 2016. IPNI.
Reference ID: 23015
Notes: 25.3 #23015e
Abstract: Early this year, the International Plant Nutrition Institute (IPNI) released its fourth soil test summary. Previous summaries were conducted in 2010, 2005, and 2001. The 2015 summary captured information on 7.3 million soil samples analyzed for potassium (K). The summary is made possible through the generous, voluntary participation of sixty-two private and public soil testing laboratories. For a complete list of participating labs, see soiltest.

IPNI and Mikkelsen, R. Plant Nutrition Today - Fall 2016 No 1: Potassium needs to attract more attention! 1-2. 2016. IPNI.
Reference ID: 23016
Notes: 25.3 #23016e
Abstract: It's well understood that plants require the right combination of the 14 essential mineral nutrients to sustain their growth. However, it frequently seems like just a few of the nutrients get most of the attention due to their cost or their environmental impacts. Potassium (K) is too often overlooked as a key component in every successful farming operation. The upcoming Frontiers of Potassium Science conference will take a close look at all aspects of K behavior in soils and plants, and how to improve potash fertilizer management.

Vliet, J. A. V., Singerland, M., and Giller, K. E. Mineral Nutrition of Cocoa. 1-53. 2015.
Reference ID: 23017
Notes: 8.1.4.1 #23017e
Abstract: This review on the mineral nutrition of cocoa was commissioned by the Scientific Committee of the Cocoa Fertiliser Initiative. In this Initiative, different industrial, governmental and knowledge partners involved in the cocoa sector have joined hands with the aim of Restoring Soil Fertility in West Africa, for a Rejuvenated and Economically Viable Cocoa Sector. It is recognised that current yields in West Africa are significantly constrained by nutritional problems. However, discrepancies remain in the current recommendations to improve nutrition in cocoa production, and their scientific basis is often unclear.

Partelli F. L. 2009. Nutrition of black pepper (Piper nigrum L.) - a Brazilian experience. Journal of Spices and Aromatic Crops, 18:73-83.
Reference ID: 23018
Notes: 8.1.7 #23018e
Abstract: Despite investment risk and price variations, among other difficulties, Brazilian farmers are still investing in black pepper (Piper nigrum) cultivation due to relative price increment over the years. Action has already been implemented, on improvement of cultivars and diagnosis, fertilization and irrigation, based on technical information for increasing the productivity of the crop. Adequate nutritional diagnosis, based on a proper sample method and regional patterns, will result in efficient input recommendation with a consequent improvement in production with higher sustainability. The DRIS (Diagnosis and Recommendation Integrated System) has been extensively used in Brazil, which contributes to efficient nutrition diagnosis and fertilizer recommendation. The use of simple cultural procedures such as use of cover crops and organic fertilization, among others, has a great potential to control weeds, improve soil quality and mineral nutrition in black pepper, contributing to sustainable production. This review includes information on research work being undertaken in Brazil, on black pepper nutrition (nutrient extraction, foliar patterns, nutritional diagnosis and fertilizer recommendations), including fertilization and diagnosis strategies for increasing the productivity of the crop.

Grabs J., B. Kilian, D. C. Hernandez, and T. Dietz. 2016. Understanding Coffee Certification Dynamics: A Spatial Analysis of Voluntary Sustainability Standard Proliferation. IFAMA, 19:1-56.
Reference ID: 23019
Notes: 8.1.5 #23019e
Abstract: Third-party Voluntary Sustainability Standards (VSS) have emerged as an increasingly popular strategy to guarantee sustainability in the coffee value chain. Yet, knowledge of the population characteristics of certified farmers, and of the influence of transnational and local supply chain actors on the uptake of VSS at the producer level, is still scarce. Using expert interviews, a comprehensive database of certificate holders and spatial mapping analyses, this paper adds to present knowledge concerning the effectiveness of VSS in the coffee sector in three ways. First, it showcases the structural, geographical and socio-economic tendencies toward VSS adoption in Guatemala, Colombia and Costa Rica, and allows first insights in the additionality and effectiveness of certification schemes derived from these indicators. Second, it contributes to an up-to-date understanding of the coffee supply chain, a sector of great economic importance both to producing and consuming countries that is in constant flux and reorganization, and it explains how current VSS interact with this type of global supply chain. Finally, through the construction of a comprehensive population of certified farmers, it enables better evaluation of existing case studies, generalizability, possible biases and provides valuable information for the preparation of future impact evaluation projects.

van Noordwijk M., N. Khasanah, and S. Dewi. 2016. Can intensification reduce emission intensity of brofuel through optimized fertilizer use? Theory and the case of oil palm in Indonesia. GCB Bioenergy, 1-13.
Reference ID: 23020
Notes: 8.1.1 #23020e
Abstract: Closing yield gaps through higher fertilizer use increases direct greenhouse gas emissions but shares the burden over a larger production volume. Net greenhouse

gas (GHG) footprints per unit product under agricultural intensification vary depending on the context, scale and accounting method. Life cycle analysis of footprints includes attributable emissions due to (i) land conversion ('fixed cost'); (ii) external inputs used ('variable cost'); (iii) crop production ('agronomic efficiency'); and (iv) postharvest transport and processing ('proportional' cost). The interplay between fixed and variable costs results in a nuanced opportunity for intermediate levels of intensification to minimize footprints. The fertilizer level that minimizes the footprint may differ from the economic optimum. The optimization problem can be solved algebraically for quadratic crop fertilizer response equations. We applied this theory to data of palm oil production and fertilizer use from 23 plantations across the Indonesian production range. The current EU threshold requiring at least 35% emission saving for biofuel use can never be achieved by palm oil if produced: (i) on peat soils, or (ii) on mineral soils where the C debt due to conversion is larger than 20 Mg C ha-1, if the footprint is calculated using an emission ratio of N2O–N/N fertilizer of 4%. At current fertilizer price levels in Indonesia, the economically optimized N fertilizer rate is 344–394 kg N ha-1, while the reported mean N fertilizer rate is 141 kg N ha-1 yr-1 and rates of 74–277 kg N ha-1 would minimize footprints, for a N2O–N/N fertilizer ratio of 4–1%, respectively. At a C debt of 30 Mg C ha-1, these values are 200–310 kg N ha-1. Sustainable weighting of ecology and economics would require a higher fertilizer/yield price ratio, depending on C debt. Increasing production by higher fertilizer use from current 67% to 80% of attainable yields would not decrease footprints in current production conditions.

Ann Y. C. 2012. Determination of nutrient uptake characteristic of black pepper (Piper nigrum L.). Journal of Agricultural Science And Technology, 2:1091-1099.
Reference ID: 23021
Notes: 8.1.7 #23021e
Abstract: The relationship between the growth and nutrient uptake by perennial crop such as pepper is poorly understood and improved understanding of such relationship is important for the establishment of rational crop management practices. In order to characterize the growth performance and quantify the nutrient removed, this study presents results of three consecutive cropping years, fertilized with 1, 2 and 3 ton ha-1 of NPK fertilizer respectively. Plant biomass accumulated was evaluated every two months, separating plant into stems, branches, leaves, berries, fruit spikes and flowers. Total biomass of pepper increased linearly and reach maximum at 22 months after planting. Thereafter, a decrease in dry matter was observed due to fruit export and fallen leaves at harvest. However, at the 28 months of planting, the biomass of pepper vine showing some increasing trend indicating the vegetative growth was reassumed for the next flowering. At 30 months, the pepper had removed 293.08 kg of nitrogen, 46.41 kg of phosphorus, 264.95 kg of potassium, 35.4 kg of magnesium and 74.82 kg of calcium. Based on data obtained, the nutrient uptake rates were lower than nutrient applied suggested that fertilizer had been overused for pepper production. In light of these results obtained, the optimum fertilizer dosage would be 62-10-62-6-18 kg/ha, 237-22-246-22-65 kg/ha and 390-62-352-47-100 kg/ha of N-P-K-Mg-Ca for the year 1, year 2 and year 3 of cropping year.

IPNI. Better Crops South Asia Vol.10 (2016, No.1). Better Crops - South Asia 10[1], 1-32. 2016. IPNI.
Reference ID: 23023
Notes: S serial #23023e
In This Issue:

4R Nutrient Stewardship in Indian Agriculture **#23024**
4R Nutrient Management for Onion in India **#23025**
4R Nutrient Stewardship of Potato: A Major Cash Crop in Eastern India **#23026**
4R Nitrogen Management for Sustainable Rice Production **#23027**
Efficient Nutrient Management of Soybean in Shrink and Swell Soils of Western India **#23028**
4R Nutrient Stewardship for Sugarcane **#23029**
4R Nutrient Stewardship for Sustainable Pulse Production in India **#23030**

Satyanarayana T., K. Majumdar, and S. K. Dutta. 2016. 4R Nutrient Stewardship in Indian Agriculture. Better Crops - South Asia, 10:5-7.
Reference ID: 23024
Notes: #23024e > S serial #23023e
Abstract: Agriculture is an integral part of the overall economic development in India. More specifically, agriculture and its allied activities contribute to nearly 50% of India's national income. Ensuring food security for India's growing population, expected to be around 1.33 billion by 2020 (Anonymous, 2014), continues to be a major challenge. IFPRI (2012) summarized several studies that showed food grain demand in India will reach 293 million (M) t by 2020 and 335 M t by 2026. The declining per capita land availability and limited scope for horizontal expansion of cultivated area requires the intensification of agricultural production through higher crop yield per unit area.

Thangasamy A. 2016. 4R Nutrient Management for Onion in India. Better Crops - South Asia, 10:8-11.
Reference ID: 23025
Notes: #23025e > S serial #23023e
Abstract: The right source of nutrient for onion must consider the soil type and all the limiting nutrients in the soil. Determining right rate depends on the growing season, yield target, and method of nutrient application. Right timing of nutrients during active vegetative growth is critical to ensure high productivity and nutrient use efficiency. Right method of nutrient application through drip fertigation seemed to be most promising for onion farmers.

Banerjee H., S. Dutta, S. Sarkar, T. Satyanarayana, and K. Majumdar. 2016. 4R Nutrient Stewardship of Potato: A Major Cash Crop in Eastern India. Better Crops - South Asia, 10:13-15.
Reference ID: 23026
Notes: #23026e > S serial #23023e
Abstract: 4R guidelines are needed to enhance potato growth stages and increase yields.

Surekha K., R. M. Kumar, V. Negendra, and T. Satyanarayana. 2016. 4R Nitrogen Management for Sustainable Rice Production. Better Crops - South Asia, 10:16-19.
Reference ID: 23027
Notes: #23027e > S serial #23023e
Abstract: Research conducted on N management in rice at the ICAR-Indian Institute of Rice Research was aimed to increase the productivity while improving N use efficiency. Bringing the current N management in rice under the concept of 4R Nutrient Stewardship can further help in achieving better economic, social, and environmental performance of N.

Katkar R. N., V. K. Kharche, B. A. Sonune, N. M. Konde, and K. Majundar. 2016. Efficient Nutrient Management of Soybean in Shrink and Swell Soils of Western India. Better Crops - South Asia, 10:20-23.
Reference ID: 23028
Notes: #23028e > S serial #23023e
Abstract: Application of the right source of nutrients for soybean recommends the inclusion of K and S in the fertilization program. Critical assessment of N application rates in soybean is required to achieve and maintain optimum yield, particularly in highly deficient soils. Split application of right rate of K, and banding it at 5 cm to the side and 5 cm below the seed are suggested to maintain soil fertility and address abiotic stresses.

Singh U., S. K. Dutta, and T. Satyanarayana. 2016. 4R Nutrient Stewardship for Sustainable Pulse Production in India. Better Crops - South Asia, 10:27-29.
Reference ID: 23030
Notes: #23030e > S serial #23023e
Abstract: 4R-based nutrient management is needed to increase productivity of pulse crops in India to meet growing demands.

Ruan J., J. Gerendas, R. Hardter, and B. Sattelmacher. 2007. Effect of Nitrogen Form and Root-zone pH on Growth and Nitrogen Uptake of Tea (*Camellia sinensis*) Plants. Annals of Botany, 99:301-310.
Reference ID: 23031
Notes: #23031e
Abstract: † Background and Aims Tea (Camellia sinensis) is considered to be acid tolerant and prefers ammonium nutrition, but the interaction between root zone acidity and N form is not properly understood. The present study was performed to characterize their interaction with respect to growth and mineral nutrition. † Methods Tea plants were hydroponically cultured with NH4 þ, NO3 2 and NH4 þ þ NO3 2, at pH 4.0, 5.0 and 6.0, which were maintained by pH stat systems. † Key Results Plants supplied with NO3 2 showed yellowish leaves resembling nitrogen deficiency and grew much slower than those receiving NH4 þ or NH4 þ þ NO3 2 irrespective of root-zone pH. Absorption of NH4 þ was 2- to 3.4- fold faster than NO3 2 when supplied separately, and 6- to 16-fold faster when supplied simultaneously. Nitrategrown plants had significantly reduced glutamine synthetase activity, and lower concentrations of total N, free amino acids and glucose in the roots, but higher concentrations of cations and carboxylates (mainly oxalate) than those grown with NH4 þ or NH4 þ þ NO3 2. Biomass production was largest at pH 5.0 regardless of N form, and was drastically reduced by a combination of high root-zone pH and NO3 2. Low root-zone pH reduced root growth only in NO3 2-fed plants. Absorption of N followed a similar pattern as root-zone pH changed, showing highest uptake rates at pH 5.0. The concentrations of total N, free amino acids, sugars and the activity of GS were generally not influenced by pH, whereas the concentrations of cations and carboxylates were generally increased with increasing root-zone pH. †Conclusions Tea plants are well-adapted to NH4 þ-rich environments by exhibiting a high capacity for NH4 þ assimilation in their roots, reflected in strongly increased key enzyme activities and improved carbohydrate status. The poor plant growth with NO3 2 was largely associated with inefficient absorption of this N source. Decreased growth caused by inappropriate external pH corresponded well with the declining absorption of nitrogen.

Pardon L., C. Bessou, P. N. Nelson, B. Dubos, J. Ollivier, R. Marichal, J.-P. Caliman, and B. Gabrielle. 2016. Key unknowns in nitrogen budget for oil palm plantations. A review. Agronomy For Sustainable Development, 36:1-21.
Reference ID: 23032
Notes: #23032e
Abstract: Nitrogen (N) losses in agroecosystems are a major environmental and economic issue. This issue is particularly pronounced in oil palm cultivation because oil palm production area is expected to increase to 12 Mha by 2050. N fertilization in oil palm plantations is mainly provided by mineral fertilizers, palm oil mill by-products, and biological fixation using legume cover crops. N loss has a major environmental impact during cultivation. For instance, 48.7 % of the greenhouse gases emitted to produce 1 t of palm oil fruit are due to N fertilization. Actually, there is little comprehensive knowledge on how to calculate N budgets in oil palm plantation in order to optimize fertilization, taking into account N leaching and N gases emissions. Here we modeled knowledge about all N fluxes in an oil palm field following standard management practices of industrial plantations, on a mineral soil, from planting to felling after a 25-year-growth cycle. The largest fluxes are internal fluxes, such as oil palm uptake, with 40– 380 kg N ha-1 year-1, and the decomposition of felled palms at the end of the cycle, with 465–642 kg N ha-1. The largest losses are emissions of NH3 and leaching of NO3 -, corresponding to 0.1 –42 % and 1–34 % of mineral N applied, respectively. The most uncertain and least documented fluxes are N losses such as N2O, NOx, N2 emissions, leaching, NH3 volatilization, and runoff. The most critical conditions for N losses occur during the immature phase when young palms uptake is low and during the mature phase in areas with sparse soil cover or receiving high amounts of fertilizers. Data is lacking about the effects of management practices on NO3- leaching and N2O/NOx emissions in those critical conditions.

Breure K. 2003. The search for yield in oil palm: Basic Principles. Pages 59-98 *in* TH Fairhurst and R Hardter, editors. Managment for Large and Sustainable Yields. Potash & Phosphate Insitute/Potash & Phosaphate Institute of Canada (PPI/PPIC) and International Potash Institute (IPI), Singapore.
Reference ID: 23033
Notes: H 8.1.1.1 #23033 > S 8.1.1 #11869
Abstract: In oil palm, as in other plants, biomass is formed by the process of photosynthesis (CO2 assimilation). In this process, carbon dioxide (CO2) from the air, and water (H2O) from the soil is converted into carbohydrates (CHO2), using solar radiation absorbed by chlorophyll in the chloroplasts of green leaves. Carbohydrates are used first to support the functioning of the palm (termed maintenance respiration). Part of what remains is used for the transport and conversion of CH2O into structural dry matter and for active nutrient uptake from the soil (termed growth respiration), and the balance is available for vegetative (leaf, trunk, root) and generative (bunch) dry matter production. Under favorable growing conditions, dry matter is apportioned about qqueally between vegetative and generative growth, but when the supply of CH2O is reduced under conditions of stress, priority is given to vegetative dry matter production.

Goh K. H.and R. Hardter. 2003. Genaral Oil Palm Nutrition. Pages 191-230 *in* TH Fairhurst and R Hardter, editors. Management for Large and Sustainable Yields. Potash & Phosphate Insitute/Potash & Phosaphate Institute of Canada (PPI/PPIC) and International Potash Institute (IPI), Singapore.
Reference ID: 23034
Notes: H 8.1.1 #23034 > S 8.1.1 #11869
Abstract: Although its economic products (palm oil and palm karnel oil) contain mainly carbon(C), hudrogen(H) and Oxygen(O), the oil palm has a large requirement for nutrients that is only surpassed by a few crops, such as banana (Soh, 1997). Whilst the first commercial oil palms were planted on fertile coastal clay soils in Malaysia, liparitic soil in North Sumatra and volcanic soils in West Sumatra, most oil palms are now planted on poor fetility status "inland" or "upland" soil in the islands of Borneo and Sumatra and in Thailand. Nutrient losses due to surface erosion and runoff are generally greater in these countries due to the predominantly hilly terrain, fragile soil structure and high rainfall. Thus, mineral fertilizers are of great importance to supplement the poor indigenous have been demostrated in many fertilizer experiments carried out in the region (Goh et al., this volume).

Roberts T. L. and J. Ryan. 2015. Soil and Food Security. Better Crops With Plant Food, 99:4-6.
Reference ID: 23035
Notes: #23035e > S serial #20735e
Abstract: The food we grow provides the energy, proteins, fats, vitamins, and minerals people need and the crop's ability to produce nutritious foods depends directly on the health of the soil. Food security and healthy, or fertile, productive soils are intrinsically linked. Indeed there is a close link between civilization and the quality of the soil; fertile productive soils supported flourishing societies while poor soils were-and still are-associated with poverty and under development.

Duxbury J., G. Lyons, and T. Bruulsema. 2015. Human Health Depends on Soil Nutrients. Better Crops With Plant Food, 99:7-8.
Reference ID: 23036
Notes: #23036e > S seriel #20735e
Abstract: The composition of soils influences the composition of crops, in turn influencing the quality of food, its contribution to human nutrition, and ultimately, human health. Agricultural management options for improvement include diversifying cropping systems and correcting deficiencies through fertilization.

Prochnow L. I. and H. Cantarella. 2015. Modifying Soil to Improve Crop Productivity. Better Crops With Plant Food, 99:10-12.
Reference ID: 23037
Notes: #23037e > S serial #20735e
Abstract: The majority of the world's agricultural lands require some degree of soil improvement in order to support sustained productivity.

Wingeyer A. and F. O. Garcia. 2015. Strategies to Protect and Conserve Soil Resources. Better Crops With Plant Food, 99:13-14.
Reference ID: 23038
Notes: #23038e > S serial #20735e
Abstract: The growing global demand for food, feed, fiber, biofuels, and biomaterials has placed a high level of pressure on agroecosystems in which soils are a key non-

renewable resource. Soil management practices should address this global demand by providing not only for agricultural productivity, but also for protection and conservation of soils. Best management practices (BMPs) for soil management should be socially acceptable, economically viable and environmentally sustainable.

Coyne M. S. and R. Mikkelsen. 2015. Soil Microorganisms Contribute to Plant Nutrition and Root Health. Better Crops With Plant Food, 99:18-20.
Reference ID: 23039
Notes: #23039e > S serial #20735e
Abstract: Soil microorganisms provide an essential function in nourishing and protecting plants. They also play a crucial role in providing soil, air, and water services that are absolutely critical to human survival. Understanding this linkage allows better nutrient management decisions.

Mikkelsen R. 2015. Soils and Plant Roots. Better Crops With Plant Food, 99:21-23.
Reference ID: 23040
Notes: #23040e > S serial #20735e
Abstract: Sustaining agricultural productivity relies on maintaining a soil environment to support the growth of healthy roots. Because roots are not immediately visible, their importance is often overlooked. A number of biological, chemical and physical stresses in the soil can impair root function and have an immediate effect on plant growth. Boosting water and nutrient use efficiency by roots is an important key for enhancing sustainable agricultural production. A few important root and soil interactions are highlighted here.

Zingore S., J. Mutegi, B. Agesa, L. Tamene, and J. Kihara. 2015. Soil Degradation in sub-Saharan Africa and Crop Production Options for Soil Rehabilitation. Better Crops With Plant Food, 99:24-26.
Reference ID: 23041
Notes: #23041e > S serial #20735e
Abstract: Soil degradation associated with poor soil fertility management practices is a major factor underlying poor agricultural productivity in sub-Saharan Africa. About 65% of the agricultural land is degraded, mainly due to low nutrient application, soil erosion and soil acidification. Increased fertilizer use and balanced nutrient management in combination with various organic matter inputs offer the best prospects to reverse soil degradation.

Mikkelsen R. 2015. Sustainable Intensification to Protect Soil Resources. Better Crops With Plant Food, 99:27-28.
Reference ID: 23042
Notes: #23042e > S serial #20735e
Abstract: Soils have a vital role in role in sustaining global food production, but soils also provide essential support for many other ecosystem services, such as storing and filtering water, sequestering greenhouse gases, processing waste materials, and hosting complex microbial and terrestrial life. Threats of soil degradation place an increased urgency to protect and replenish soils. Experts calculate a need for 70% more food production by 2050 in order to feed the growing global population. Without improved stewardship of soil resources, it will be impossible to meet this expanding demand. Leading farmer, scientific, and government groups are rallying around the principle of "sustainable intensification". This concept calls for increasing food

production from existing farmland using methods that present less pressure on the environment.

Arnall B. and S. Phillips. 2015. Applying 4R Nutrient Stewardship Principles in Precision Soil Management. Better Crops With Plant Food, 99:29-31.
Reference ID: 23043
Notes: #23043e > S serial #20735e
Abstract: The goal of every land manager is to be as efficient and productive as possible. In other words, obtain maximum output with minimum input. As we explore the application of the 4R's in soil management, it becomes apparent that application of the 4R's can be closely linked with many existing precision agriculture (PA) technologies.

Bender R. R., W. J. Haegele, and F. E. Below. 2015. Modern Soybean Varieties' Nutrient Uptake Patterns. Better Crops With Plant Food, 99:7-10.
Reference ID: 23044
Notes: #23044e > S serial #20790e
Abstract: Many soybean fertility recommendations are derived from research conducted during the 1930s to 1970s, and may not be adequate in supporting the nutritional needs of the greater biomass accumulation and seed yield associated with current soybean germplasm and production systems. Furthermore, no recent data exist that document the cumulative effects of improved soybean varieties, fertilizer source and placement technologies, and plant health/plant protection advancements on the rate and duration of nutrient accumulation in soybean. A more comprehensive understanding of soybean's nutritional requirements may be realized through this evaluation of the season-long nutrient uptake, partitioning and remobilization patterns in soybean.

Kurwakumire N., R. Chikowo, A. Johnston, and S. Zingore. 2015. Role of Soil Productivity in Nutrient and Water Use in Zimbabwe. Better Crops With Plant Food, 99:11-12.
Reference ID: 23045
Notes: #23045e > S serial #20790e
Abstract: Addressing soil variability is a critical part of making site-specific fertilizer recommendations. Research in Zimbabwe evaluated crop yield responses on soils varying in organic carbon content. The research confirms balanced nutrient management had an overriding effect on maize grain yield and water productivity, but only when soil organic carbon (SOC) was >4 g/kg soil.

Pauli N., C. Donough, T. Oberthur, J. Cock, R. Verdooren, Rahmadsyah, G. Abdurrohim, K. Indrasura, A. Lubis, T. Dolong, J. M. Pasuquin, and M. Fisher. 2015. Changes in Soil Quality Indicators under Oil Palm Plantations Receiving Best Management Practices. Better Crops With Plant Food, 99:13-14.
Reference ID: 23046
Notes: #23046e > S serial #20790e
Abstract: The effect of best management practices (BMPs) to intensify oil palm production and improve yield were evaluated in Indonesia and Malaysia. While no clear, consistent differences were found in the soil properties between BMP and reference (REF) treatments over four years, improvements in soil pH and % soil organic carbon (SOC) were recorded for both treatments. The study found no significant deterioration in the measured soil properties over the four years, suggesting

that appropriate management practices for oil palm can improve several aspects of soil quality.

Deen B., K. Janovicek, J. Lauzon, and T. Bruulsema. 2015. Optimal Rates for corn nitrogen depend more on weather than price. Better Crops With Plant Food, 99:16-17.
Reference ID: 23047
Notes: #23047e > S serial #20790e
Abstract: Corn yield response to N fertilizer varies from year-to-year owing to weather. Optimal N rates depend on the yield response, and also vary with the price ratio between fertilizer and corn. In a trial in Elora, Ontario, optimal N rates over six years varied more than three times as much due to differences in weather as compared to differences in price ratio. While small profit gains can be achieved by adjusting N rates for price ratio, there is much more potential profitability and environmental benefit to be gained in better adapting N management to weather.

Mandal D., B. Datta, M. Chaudhury, and S. K. Dey. 2015. Nutrient requirement for natural rubber. Better Crops With Plant Food, 99:19-20.
Reference ID: 23048
Notes: #23048e > S serial #20790e
Abstract: The need to improve fertilizer application within the mature rubber plantations of Tripura, India is apparent given the importance of the crop and the poor fertility soils upon which it is grown. Field study suggests an application of 60 kg N and 60 kg P2O5 /ha along with an insurance application of K increased rubber yield significantly. Fertilizer response curves and soil test-based fertilizer application rates suggest a general fertilizer recommendation of 45 kg N,45 kg P2O5and 40 kg K2O/ha for mature rubber plantations.