New Entries to IPNI Library as References

[1] S. Panichapong, P. Monchareon, P. Vijarnsorn. (1984). Proceedings of the Fourth International Forum on Soil Taxonomy and Agrotechnology Transfer. 7-24 February 1983, Bangkok Thailand. pp 1 - 421.
Reference ID: 24177
Note: #24177e

[2] F. Yang, X. Xu, J. Ma, P. He, M.F. Pampolino, W. Zhou. (2017). Experimental validation of a new approach for rice fertiliser recommendations across smallholder farms in China. Soil Research. 55 pp 579 - 589.
Reference ID: 24178
Note: #24178e
Abstract: Inappropriate fertiliser applications have caused a series of environmental problems and threaten the sustainable production of rice in China. The aim of this study was to evaluate the effects of a new approach, Nutrient Expert (NE), a nutrient decision support tool for rice (*Oryza sativa* L.). Experimental validation was carried out under field conditions from 2013 to 2015 at 211 sites in the main rice-growing regions of China. The results showed that, compared with current farmers' fertiliser practices (FP) and soil testing (ST), the NE approach balanced nutrient application – decreased the nitrogen (N) and potassium (K) rates, and increased the phosphorus (P) rate – and improved grain yield, nutrient uptake, and fertiliser use efficiency. The NE treatment produced a 3.5–6.3% higher grain yield, 2.3–14.2% higher N, P, and K uptake in aboveground plant dry matter, and higher agronomic efficiency, apparent recovery efficiency (RE), and partial factor productivity of applied N and K, but not for P. In particular, the RE of the NE approach was greater by 12.2 and 8.4 percentage points for N, 3.7 and 2.9 percentage points for P, and 16.3 and 6.4 percentage points for K, compared with FP and ST respectively. The results obtained from field validation suggested that the NE approach could predict target yields; nutrient uptake of N, P, and K within specific ranges; and could be used as a tool to make fertiliser recommendation for rice in China.

[3] J.T. Gilmour. (2017). Preparing for the 2018 International Certified Crop Adviser Exam. pp 1 - 158.
Reference ID: 24179
Note: S 13.6 #24179
Abstract: The International Certified Crop Adviser Exam is based on performance objectives which can be thought of as areas of expertise that a Certified Crop Adviser should possess. The purpose of this review manual is to provide information on each of these performance objectives which will be helpful in preparation for the International Certified Crop Adviser Exam.

[4] C. Hershey. (2017). Achieving sustainable cultivation of cassava Vol 1: Cultivation techniques. pp 1 - 405.
Reference ID: 24180
Note: S 8.4.1 #24180

[5] C. Hershey. (2017). Achieving sustainable cultivation of cassava Vol 2: Genetics, breeding, pests and diseases. pp 1 - 300.
Reference ID: 24181
Note: S 8.4.1 #24181

[6] C & CI. (2017). C&CI: Coffee and Cocoa International May 2017. 44 pp 1 - 50.
Reference ID: 24182
Note: S serial #24182

[7] C & CI. (2017). C&CI: Coffee and Cocoa International July 2017. 44 pp 1 - 50.
Reference ID: 24183
Note: S serial #24183

[8] C & CI. (2017). C&CI: Coffee and Cocoa International September 2017. 44 pp 1 - 50.
Reference ID: 24184
Note: S serial #24184

[9] ISP. (2017). The Planter Vol 93 No 1095 June 2017. 93 pp 399 - 456.
Reference ID: 24185
Note: S serial #24185

[10] G.M.M. Bari, M.A.T. Sohel. (2017). Integrated Management Packages for Pod Borer (*Maruca vitrata*) in Country Bean. The Planter. 93(1095) pp 407 - 415.
Reference ID: 24186
Note: #24186e > S serial #24185
Abstract: A field experiment was conducted in the research field of the Entomology Division of Regional Agricultural Research Station (RARS), Bangladesh Agricultural Research Institute (BARI), Jessore, Bangladesh during the winter cropping season in 2013-14 to evaluate several management packages against legume pod borer (*Maruca Vitrata*) of country bean to increase yield with a minimum cost of production.

[11] C.M. Su, J.C.F. Bong, K. Ahmad. (2017). Field Ablation as Cultural Control for Bunch Moth *Tirathaba mundella* Infestation in Young Mature Oil Palm. The Planter. 93(1095) pp 421 - 431.
Reference ID: 24187
Note: #24187e > S serial #24185
Abstract: The oil palm bunch moth, *Tirathaba mundella,* is becoming an oil palm bunch feeding pest of significant economic importance especially on peat soil in Sarawak. The goal of this research was to investigate the cultural control effect of field ablation on heavily infested young mature oil palm planted on peat by *T. mundella*.

[12] F. Garcia. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 3: Soil Sampling: the beginning for the RIGHT diagnosis. 4(3) pp 1 - 2.
Reference ID: 24188
Note: #24188e
Abstract: 4R Nutrient Stewardship is fundamentally based on the diagnosis of soil fertility. This is because soil sampling is commonly the first and critical step in identifying the soil fertility status of any field or management zone.

[13] M. Stewart. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 2: Nitrogen and the Soybean Yield Gap. 4(2) pp 1 - 2.
Reference ID: 24189
Note: #24189e
Abstract: Irrigated field experiments conducted in both Argentina and Nebraska, found that yield response to N fertilizer can occur above 37 bu/A. …at least half of the current yield gap for irrigated soybeans in the central U.S. Great Plains may be a result of a seasonal N supply limitation.

[14] H. Peterson. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 1: Phosphorus and the Human Diet. 4(1) pp 1 - 2.
Reference ID: 24190
Note: #24190e
Abstract: Similar to soil-nutrient interactions, if human P intake is too high, it can lead to nutrient deficiencies or adversely affect the body's ability to effectively use other minerals...

[15] S. Cook, F. Evans, M. Lacoste, H. Abbiss, M. Ridout, T. Oberthur, R. Bramley. 2017. OFE to support Digital Agriculture - Australia & South-East Asia: Research Directions. Los Angeles On-farm Experiments Workshop 15/12/2017. Los Angeles.
Reference ID: 24191
Note: #24191e

[16] R. Valencia, R. Montúfar, H. Navarrete, H. Balslev. (2013). Palmas Ecuatorianas: Biología y Uso Sostenible (Ecuadorian Palms: Biology and Sustainable Use). pp 1 - 136.
Reference ID: 24192
Note: #24192e (Note: Book is in spanish. Title and abstract translated via google translate)
Abstract: Palmas ecuatorianas: biologia y uso sustenible es unia revision de la familia de plantas con mayor numero de usos y de subresaliente importancia economica en ecuador. El libro explora la diversidad y el endemismo de las palmas, los usos, las practicas de manejo, el mercado de productos y la legislacion relativa a su aprovechamiento. La segunda parte presenta el tratamiento de 15 especies seleccionadas por su relevancia economica historica y actual o por ser parte del acervo cultural. En cada caso se revisa la biologia, las practicas de manejo, el estado de conservacion y se productos.
Translated: Ecuadorian palms: biology and sustainable use is a revision of the family of plants with the greatest number of uses and of sub-economic importance in Ecuador. The book explores the diversity and endemism of the palms, the uses, the management practices, the market of products and the legislation related to their use. The second part presents the treatment of 15 species selected for their historical and current economic relevance or for being part of the cultural heritage. In each case the biology, the management practices, the state of conservation and products are reviewed.

[17] IPNI. 2014. Research With Impact - Improved 4R Nitrogen Management Leads to Reduced Nitrous Oxide Emissions.
Reference ID: 24193
Note: #24193e
Abstract: THE CHALLENGE: Nitrogen fertilizer has been identified as a significant

source of agricultural greenhouse gas emissions. In particular, nitrous oxide is a potent greenhouse gas with a heat-trapping potential almost 300 times greater than carbon dioxide. A number of food sustainability groups, environmental advocates, and scientific organizations are working to develop a path for reducing nitrous oxide emissions.

[18] IPNI. 2016. Research With Impact - Access to Critical Soil Test Values Makes Better Fertilizer Decisions.
Reference ID: 24194
Note: #24194e
Abstract: THE CHALLENGE: An important first step in determining fertilizer strategies is soil testing. The critical value for a soil test indicates the likelihood of a crop response to an added nutrient but often these values are not substantiated or accessible. The grains industry in Australia recognized that making the data behind soil test critical values visible and available to cross examination would assist growers and their advisers make better fertilizer decisions.

[19] Y. Zuraidah, M.H. Haniff, H. Zulkifli. (2015). Oil Palm Roots Adaptation under Soil Compacted by Mechanization. International Journal of Agricultural Science and Research. 5(4) pp 331 - 341.
Reference ID: 24195
Note: #24195e
Abstract: Mechanization in oil palm plantations alters the soil physical properties, which consequently restrict the growth and function of roots. This study was carried out to evaluate the consequences of compaction due to mechanization on oil palm roots. Comparisons were made on the effects of different trailer weights on oil palm roots growth and their ability to adapt to the altered soil conditions. Roots were sampled using root auger at 0-30 cm depth at the harvesting paths and frond pile areas. The results showed that the growth of oil palm roots was altered by the mechanization treatments. A greater root biomass was observed in the control, while the treated plots showed a decreasing trend in root biomass with increasing trailer weight. The 4T trailer weight treatment had significant effects on the oil palm root development. The reduction in total root biomass in the compacted plots was compensated by higher tertiary and quaternary roots biomass. This resulted in a significant increase in root surface area for better water and nutrient uptake as compared to the control. The compaction treatments influenced the soil physical properties, which in turn affected the growth and distribution of oil palm roots.

[20] Argus FMB. (2017). Fertilizer Focus November/December 2017. November/December 2017 pp 1 - 41.
Reference ID: 24196
Note: #24196e

[21] T. Oberthur, H. Sugianto, R. Lim, S.P. Kam, C Donough, S. Cook, S. Primananda, K.W. Lo, P.G. Gan, A. Musthofa. (2017). Estate Scale Experiments (ESE): Continuously improving response to fertilizer in large commercial oil palm operations. Fertilizer Focus. November/December 2017 pp 32 - 36.
Reference ID: 24197
Note: #24197e > #24196e
Abstract: Working out how inputs generate profits. Fertilizer is a major expense to plantations, the largest variable cost to plantation managers. Few doubt its importance

to continued high productivity. After decades of trials, we know about its general benefits to sustained high productivity. However, how much do managers really know about the payback from fertilizer on their estates? Knowing the general effect of an input and knowing its specific effect, under normal production conditions are two completely different things.

[22] IPNI. (2017). Better Crops With Plant Food Vol.101 (2017, No.4). 101 pp 1 - 32.
Reference ID: 24198
Note: #24198e

[23] A.J. Franzluebbers. (2017). Fostering the Future with Forages…The Case for Pasture-Crop Rotations. Better Crops With Plant Food. 101(4) pp 3 - 5.
Reference ID: 24199
Note: #24199e > #24198e
Abstract: Forages are a key component of natural resource conservation in agricultural systems.
Integration of crop and livestock systems can enhance production while preserving environmental quality.
Native warm-season grasses offer flexibility for fodder and biofuel production.

[24] M. Jr. Rouquette, M.L. Silveira. (2017). Stocking Rate and Fertilization Influence Sustainability of Bermudagrass Pasture. Better Crops With Plant Food. 101(4) pp 6 - 10.
Reference ID: 24200
Note: #24200e > #24198e
Abstract: Long-term stocking of bermudagrass pastures provides for enhanced cycling of plant nutrients with minimal environmental concerns on sandy soils.
With high stocking rate, bermudagrass pasture integrity was better maintained with application of N fertilizer compared to relying solely on N fixation from clover.

[25] E. Francisco, G.C. Lupatini, R. Heinrichs. (2017). NPK Management for Forage Grasses in Brazil. Better Crops With Plant Food. 101(4) pp 10 - 12.
Reference ID: 24201
Note: #24201e > #24198e
Abstract: Most pasture land in Brazil is inherently low in nutrients and improved soil fertility and acidity management has the potential to raise both animal performance and the efficiency of beef production.
This article reviews forage fertility management – highlighting its impact on yield, quality, and system profitability.

[26] R. Norton, R. Simpson. (2017). Five-Step Approach to Phosphorus Use on Clover-Based Pastures. Better Crops With Plant Food. 101(4) pp 13 - 16.
Reference ID: 24202
Note: #24202e > #24198e
Abstract: A five-step approach involves soil testing, determining stocking rates based on the soil test values and the environment, calculating maintenance and capital P requirements to meet those stocking rates, determining if the strategy is profitable, and checking to ensure other limiting factors are addressed.

[27] N. Clark, S. Orloff, M. Ottman. (2017). Fertilizing High Yielding Alfalfa in California and Arizona. Better Crops With Plant Food. 101(4) pp 21 - 23.
Reference ID: 24203
Note: #24203e > #24198e
Abstract: Some of the highest alfalfa yields in the world are grown in California and Arizona, with yields as high as 24 t hay/A reported. Three distinct alfalfa-growing environments provide examples of the nutrient management required to achieve high yields.

[28] W. Anderson, M. Stewart. (2017). Tifton 85 Bermudagrass Response to Fertilization on Two Coastal Plain Soils. Better Crops With Plant Food. 101(4) pp 24 - 26.
Reference ID: 24204
Note: #24204e > #24198e
Abstract: Among the forage bermudagrasses, Tifton-85 is recognized for several positive attributes that led to it being the cultivar of choice in many regions of the world. Given its greater yield potential and improved quality characteristics compared to other bermudagrasses, a more tailored approach to nutrient management would benefit Tifton-85 producers …which was the goal of the work reported here.

[29] G. Bélanger, N. Ziadi. (2017). Critical Phosphorus Concentration in Cool Season Forage Grasses. Better Crops With Plant Food. 101(4) pp 27 - 28.
Reference ID: 24205
Note: #24205e > #24198e
Abstract: Improved methods for predicting fertilizer P requirements of field crops, including forage grasses, are required to minimize the risk of surface and groundwater contamination from excessive fertilization, while still applying sufficient P to optimize crop yield.
Because soil P tests are not always reliable predictors of fertilizer P requirements, the crop P status could be an alternative or a complement as an indicator of soil P availability

[30] M. Castillo. (2017). Forage Quality: Concepts and Practices. Better Crops With Plant Food. 101(4) pp 29 - 31.
Reference ID: 24206
Note: #24206e > #24198e
Abstract: Forage quality is a determinant of animal performance.
Nutritive value and intake factors determine forage quality.
Forage quality estimates and indices can aid in allocation of forages among different classes of animals.

[31] BC Insight. (2017). Fertilizer International Number 480 September/October 2017. 480 pp 1 - 50.
Reference ID: 24207
Note: #24207e

[32] IFA. (2017). IFA 2030 Survey Result. IFA Strategic Forum 14-15 November 2017 Zurich Switzerland. IFA.
Reference ID: 24208
Note: #24208e

[33] P. Heffer, A. Gruere, T. Roberts. (2017). Assessment of Fertilizer Use by Crop at Global Level 2014-2014/15 (IPNI/IFA). pp 1 - 20.
Reference ID: 24209
Note: #24209e
Abstract: Fully understanding the contribution of the different crop types to fertilizer use at the national, regional and global levels is an essential component of fertilizer consumption analysis and a prerequisite to the development of sound fertilizer demand forecasts and scientific assessments and modelling. However, this information is rarely available, challenging to collect, and time-consuming to process. In order to fill the gap, the International Fertilizer Association (IFA) carries out regular surveys (every 3 to 4 years) on fertilizer use by crop in the main fertilizer-consuming countries. This survey benefited from the agronomic expertise of the International Plant Nutrition Institute (IPNI) to validate estimates.

[34] P. Marschner. (2012). Marschner's Mineral Nutrition of Higher Plants. pp 1 - 651.
Reference ID: 24210
Note: #24210e (this ebook is in folder #24210 and divided into chapters)

[35] IFA. 2015. Advancing Sustainable Fertilizer Management. pp 1 - 4.
Reference ID: 24211
Note: #24211e
Abstract: Promote sustainable fertilizer management, conduct authoritative market analysis related to fertilizer demand, and monitor policy, scientific and other developments that may impact present and future demand.

[36] M.M. Afidchao, C.J.M. Musters, A. Wossink, O.F. Balderama, G.R. de Snoo. (2014). Analysing the farm level economic impact of GM corn in the Philippines. NJAS - Wageningen Journal of Life Sciences. 70 - 71 pp 113 - 121.
Reference ID: 24212
Note: #24212e
Abstract: This paper analyses the farm economic viability of genetically modified (GM) corn in the Philippines. Data was collected from 114 farmers in Isabela province including non-GM, *Bacillus thuringiensis* (Bt), herbicide tolerant (HT) and *Bt*HT corn farmers. Results of univariate analysis showed that non-GM corn was not statistically different from *Bt, Bt*HT and HT corn in terms of production output, net income, production-cost ratio and return on investment. Multivariate econometric analysis for the agronomic input variables showed a higher return on investment for *Bt* corn as the only significant difference between seed types. Next, pest occurrence and severity variables were included in the regression to address endogeneity. The Blinder-Oaxaca decomposition method was used to further investigate differences between growers of *Bt*HT corn and non-GM corn into an endowment and a coefficient effect. The decomposition analysis showed that *Bt*HT corn has a negative impact on return on investment as revealed by the negative signs of the overall mean gap and the characteristics and coefficient components. In contrast, the overall mean gap for net income indicated that adopting *Bt*HT corn could potentially increase non-GM growers' income mainly from better control of corn borer pest even though mean levels of borer occurrence are lower for non-GM growers.

[37] R.M. Bautista, N.N. San. (1998). Modeling the Price Competitiveness of Indonesian Crops. Journal of Asian Economics. 9(3) pp 425 - 443.
Reference ID: 24213
Note: #24213e
Abstract: In this article, we examine quantitatively the determinants of relative domestic prices of four major nonrice crops in Indonesia using an analytical framework that distinguishes between the effects of domestic policies and external factors. A decomposition analysis is undertaken on the changes in price competitiveness of each crop between subperiods during 1970-94, involving the following components: (a) changes in the foreign price; (b) changes in the real exchange rate; and (c) changes in sectoral protection. To disentangle the effects of domestic policies, a real exchange rate equation is econometrically estimated for Indonesia in which the main explanatory variables are the external terms of trade, trade policy, current account balance (assumed dependent on macroeconomic policies), and the nominal exchange rate (a short-run influence).

[38] T.L.T. Nguyen, S.H. & Gheewala, S. Bonnet. (2008). Life cycle cost analysis of fuel ethanol produced from cassava in Thailand. International Journal of Life Cycle Assessment. pp 1 - 10.
Reference ID: 24214
Note: #24214e
Abstract: Background, aim, and scope: As a net oil importer, Thailand has a special interest in the development of biofuels, especially ethanol. At present, ethanol in the country is mainly a fermentation/distillery product of cane molasses, but cassava holds superior potential for the fuel. This study aims to assess the economics of cassava-based ethanol as an alternative transportation fuel in Thailand. The scope of the study includes the cassava cultivation/processing, the conversion to ethanol, the distribution of the fuel, and all transportation activities taking place within the system boundary.
Materials and methods: The life cycle cost assessment carried out follows three interrelated phases: data inventory, data analysis, and interpretation. The functional unit for the comparison between ethanol and gasoline is the specific distance that a car can travel on 1 L ethanol in the form of E10, a 10% ethanol blend in gasoline.
Results: The results of the analysis show, despite low raw material cost compared to molasses and cane-based ethanol, that cassava ethanol is still more costly than gasoline. This high cost has put an economic barrier to commercial application, leading to different opinions about government support for ethanol in the forms of tax incentives and subsidies.
Discussion: Overall, feedstock cost tends to govern ethanol's production cost, thus, making itself and its 10% blend in gasoline less competitive than gasoline for the specific conditions considered. However, this situation can also be improved by appropriate measures, as discussed later.
Conclusions: To make ethanol cost-competitive with gasoline, the first possible measure is a combination of increasing crop yield and decreasing farming costs (chemical purchase and application, planting, and land preparation) so as to make a 47% reduction in the cost per tonne of cassava. This is modeled by a sensitivity analysis for the cost in the farming phase. In the industrial phase of the fuel production cycle, utilization of co-products and substitution of rice husk for bunker oil as process energy tend to reduce 62% of the price gap between ethanol and gasoline. The remaining 38% price gap can be eliminated with a 16% cut of raw material (cassava) cost, which is more practical than a 47% where no savings options in ethanol conversion phase are taken into account.

Recommendations and perspectives: The life cycle cost analysis helps identify the key areas in the ethanol production cycle where changes are required to improve cost performance. Including social aspects in an LCC analysis may make the results more favorable for ethanol.

[39] Statista. (2017). Brand Building: Coffee - Growth-Trends-Consumer Views. Whitepaper 2017. Statista.
Reference ID: 24215
Note: #24215e

[40] Argus Media. 2017. Growth Prospects for NPK. pp 1 - 3.
Reference ID: 24216
Note: #24216e
Abstract: Crop prices have remained below their five-year average for the last two years, according to the UN Food and Agriculture Organization's January 2017 report, and despite the fact that grain prices are 50pc higher than they were 10 years ago, farmer perceptions focus on the shorter term.

[41] R.C.Y. Cheong. (2013). The Traceability and Sustainability Control of Biofuels from Waste and Residual Biomass Materials. Biomass Asia 2013. Sunway Putra Hotel, Malaysia. TUV Nord.
Reference ID: 24217
Note: #24217e

[42] Down to Earth. (2007). Oil Palm Plantation Expansion in Indonesia. FME May 2007.
Reference ID: 24234
Note: #24234e

[43] S Rahutomo. (2016). BMP's for facing drought stress on Oil Palm (paper 1). ISOPA- Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment 28-29 September 2016 Marihat. Marihat, North Sumatra. ISOPA.
Reference ID: 24235
Note: #24235e

[44] N.E. Prabowo, M.M. Lubis. (2016). Alleviating seasonal water deficit for a sustained oil palm production(paper 2). ISOPA- Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment 28-29 September 2016 Marihat, North Sumatra. Marihat, North Sumatra. ISOPA.
Reference ID: 24236
Note: #24236e

[45] Surianto. (2016). BMPs of Oil Palm in Sandy Soil (Paper 3). ISOPA- Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment 28-29 September 2016 Marihat, North Sumatra. Marihat, North Sumatra. ISOPA.
Reference ID: 24237
Note: #24237e

[46] O. Hasnol, A.M. Afandi, H. ZUlkifli, M.D. Farawahida, Y. Zuraidah, Zuhaili. (2016). How to Optimize Oil Palm Production on Marginal Land In Malaysia (Paper 4). ISOPA-Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment 28-29 September 2016 Marihat, North Sumatra. Marihat, North Sumatra. ISOPA.
Reference ID: 24238
Note: #24238e

[47] ISOPA. (2016). ISOPA- Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment Program Book. ISOPA- Field Clinic and Colloquium: Oil Palm BMP for Challenging Environment 28-29 September 2016 Marihat, North Sumatra. pp 1 - 33.
Reference ID: 24239
Note: #24239e
Abstract: Objectives:
To be familiar with Best Management Practices used for sustainable oil palm yield production in marginal soils.
To share information on the Best Management Practices adopted on marginal land in Malaysia.
Hands on training on counting the number of *Elaeidobius kamerunicus* and hatch & carry technique used to increase oil palm fruit set.

[48] A.K. Singh, J.S. Bohra. (2012). Competitive indices of wheat + compact-mustard intercropping in a 5:1 row proportion as influenced by fertilizer doses and seed rates of wheat varieties. Archives of Agronomy and Soil Science. 58(12) pp 1399 - 1412.
Reference ID: 24240
Note: #24240e
Abstract: A field experiment in a split-plot design with three replications was conducted on wheat + compact-mustard intercropping in a 5:1 row proportion at the research farm, Institute of Agricultural Sciences, Banaras Hindu University, India, during the winter seasons of 2005–2006 and 2006–2007. The main plot treatment involved a combination of three fertilizer doses [100, 120 and 140% recommended fertilizer dose (RFD) to wheat, accompanied by 100% RFD to mustard] and two wheat varieties (HD-2824 and HUW-468); the subplot treatment consisted of three seed rates of wheat (100, 115 and 130 kg ha^{-1}). The treatment differences were studied intensively in light of the various reciprocity indices. Wheat variety HD-2824 at 115 kg ha^{-1} seed rate and 140% RFD, intercropped with compact-mustard variety Sanjukta Aschesh at 100% RFD in a 5:1 row proportion, resulted in the best land utilization, maximum productivity and monetary advantage. Among the various yield indices studied, area time equivalent ratio (ATER), competitive ratio (CR) and effective land equivalent ratio (LER) curves were found to be good for comparing the variations in fertilizer doses and seed rates used in wheat varieties. Nevertheless, to compare monetary advantage, the monetary advantage index (MAI) based on LER proved a better index than intercropping advantage (IA), which is based on actual yield loss (AYL).

[49] S. Keivanrad, B. Delkhosh, A.H.S. Rad, P. Zandi. (2012). The Effect of Different Rates of Nitrogen and Plant Density on Qualitative and Quantitative traits of Indian mustard. Advances in Environmental Biology. 6(1) pp 145 - 152.
Reference ID: 24241
Note: #24241e
Abstract: To understand the effect of plant density and amounts of nitrogen fertilizer

on some agronomic characteristics of Indian mustard, an experiment was laid out as a randomized complete block design with splitplot arrangement with three replications. Nitrogen fertilizer levels (0, 50, 100, 150 and 200 kg N/ha) were allotted to main plots and subplots were consisted of three levels of plant densities (80, 100 and 120 plants/ m^2). The results indicated that, plant density had a highly significant effect on plant height, seed/siliqua, siliqua/plant, seed yield, biologic yield, 1000-seed weight, oil content and oil yield ($p<0.01$). All tested traits (qualitative and quantitative ones) were significantly affected by nitrogen fertilizer ($p<0.01$). Nitrogen×plant density interaction also significantly affected all tested traits ($p<0.05$) except for plant height and siliqua/plant. Our findings suggest that for semi-arid zone of Takestan, Indian mustard due to its high adaptation to arid conditions can be a good option for spring rapeseed replacement.

[50] B. Phalan, R. Green, A. Balmford. (2014). Closing yield gaps: perils and possibilities for biodiversity conservation. Philosophical Transactions of Royal Society B. 369 pp 1 - 16.
Reference ID: 24242
Note: #24242e
Abstract: Increasing agricultural productivity to 'close yield gaps' creates both perils and possibilities for biodiversity conservation. Yield increases often have negative impacts on species within farmland, but at the same time could potentially make it more feasible to minimize further cropland expansion into natural habitats. We combine global data on yield gaps, projected future production of maize, rice and wheat, the distributions of birds and their estimated sensitivity to changes in crop yields to map where it might be most beneficial for bird conservation to close yield gaps as part of a land-sparing strategy, and where doing so might be most damaging. Closing yield gaps to attainable levels to meet projected demand in 2050 could potentially help spare an area equivalent to that of the Indian subcontinent. Increasing yields this much on existing farmland would inevitably reduce its biodiversity, and therefore we advocate efforts both to constrain further increases in global food demand, and to identify the least harmful ways of increasing yields. The land-sparing potential of closing yield gaps will not be realized without specific mechanisms to link yield increases to habitat protection (and restoration), and therefore we suggest that conservationists, farmers, crop scientists and policy-makers collaborate to explore promising mechanisms.

[51] J. Liu, G. Wang, Q. Chu, F. Chen. (2017). Strategies for narrowing the maize yield gap of household farms through precision fertigation under irrigated conditions using CERES-Maize model. Journal of the Science of Food and Agriculture. 97 pp 2736 - 2741.
Reference ID: 24243
Note: #24243e
Abstract: BACKGROUND: Nitrogen (N) application significantly increases maize yield; however, the unreasonable use of N fertilizer is common in China. The analysis of crop yield gaps can reveal the limiting factors for yield improvement, but there is a lack of practical strategies for narrowing yield gaps of household farms. The objectives of this study were to assess the yield gap of summer maize using an integrative method and to develop strategies for narrowing the maize yield gap through precise N fertilization.
RESULTS: The results indicated that there was a significant difference in maize yield among fields, with a low level of variation. Additionally, significant differences in N

application rate were observed among fields, with high variability. Based on long-term simulation results, the optimal N application rate was 193 kg ha^{-1}, with a corresponding maximum attainable yield (AY_{max}) of 10 318 kg ha^{-1}. A considerable difference between farmers' yields and AY_{max} was observed. Low agronomic efficiency of applied N fertilizer (AE_N) in farmers' fields was exhibited.
CONCLUSION: The integrative method lays a foundation for exploring the specific factors constraining crop yield gaps at the field scale and for developing strategies for rapid site-specific N management. Optimization strategies to narrow the maize yield gap include increasing N application rates and adjusting the N application schedule.

[52] M.A. Schnurr. (2017). GMOs and poverty: yield gaps, differentiated impacts and the search for alternative questions. Canadian Journal of Development Studies. 38(1) pp 149 - 157.
Reference ID: 24244
Note: #24244e
Abstract: This short commentary reflects on the question: Can genetically modified (GM) crops help the poor? It aims not to provide a definitive answer but rather to grapple with the question itself, in the hope of illuminating some of the critical assumptions and values that shape exchanges on this polarising and politicised question.
RÉSUMÉ
Ce court commentaire se veut une réflexion sur la question: Les cultures génétiquement modifiées (GM) peuvent-elles aider les pauvres? Le but n'est pas d'apporter une réponse définitive mais plutôt de débattre de cette question, à la fois polarisante et politisée, dans l'espoir d'éclairer quelques-unes des suppositions et valeurs cruciales qui façonnent les échanges qu'elle provoque.

[53] D.I. Gustafson, J.W. Jones, C.H. Porter, G. Hyman, M.D. Edgerton, T. Gocken, J. Shryock, M. Doane, K. Budreski, C. Stone, D. Healy, N. Ramsey. (2014). Climate adaptation imperatives: untapped global maize yield opportunities. International Journal of Agricultural Sustainability. 12(4) pp 471 - 486.
Reference ID: 24245
Note: #24245e
Abstract: Climate change represents an unavoidable and growing challenge to food security, imposing new adaptation imperatives on all farmers. Maize is arguably the world's most productive grain crop, as measured by grain yield. However, maize yields vary dramatically due to many factors, including soils, climate, pests, disease, agronomic practices, and seed quality. The difference between observed yields and those achievable by optimized crop production methods is called the yield gap. In this work we quantified the current yield gap for 44 countries through the use of a large private-sector data set recently made available to the crop modelling community. The yield gap was quantified for three groups of countries, categorized by level of intensification. Observed yield gaps for high, medium, and low levels of intensification are 23%, 46%, and 68%, respectively. If all maize production countries were able to shrink their yield gap to 16.5% (as in the USA) an additional 335 million metric tons (MMT) of maize grain would be produced. This represents a 45% increase over the 741 MMT produced by these countries in 2010. These data demonstrate that a major untapped maize yield opportunity exists, especially in those countries where intensification has not kept pace with the rest of the world.

[54] L. Bua, J. Liu, L. Zhu, S. Luo, X. Chen, S. Li. (2014). Attainable yield achieved for plastic film-mulched maize in response to nitrogen deficit. European Journal of Agronomy. 55 pp 53 - 62.
Reference ID: 24246
Note: #24246e
Abstract: Nitrogen (N) stress limits the yields of maize (*Zea mays* L.) that have been plastic film-mulched in northwest China. Using the tested Hybrid-Maize simulation model, which was combined with field experiments using four levels of N fertilisers (0, 100, 250 and 400 kg N ha^{-1}), we aimed to understand the variability of the attainable yield in response to N stress under plastic film mulching. We show that the application of N250 or N400 results in 100% simulated potential LAI, which is, thus, close to 100% of the simulated potential of both biomass and grain yield. However, N stress treatments significantly decreased the biomass and grain yields, achieving only 40–50% of the simulated potential (N0 treatment) and 70–80% of the simulated potential (N100 treatment). Growth dynamic measurements showed that N stress significantly decreased the LAI, delaying the source capacity growth (canopies) around the silking stage and resulting in lower final kernel numbers. The lower LAI resulted in decreased dry matter accumulation and allocation during the reproductive stage; this decrease led to a decrease in the kernel growth rate and in the grain filling duration, which resulted in a significantly lower kernel weight. This knowledge could be helpful for the optimisation of N management to close the yield gaps of dryland maize in semi-arid monsoon climate regions.

[55] M. Wang, L. Wang, Z. Cui, X. Chen, J. Xie, Y. Hou. (2017). Closing the yield gap and achieving high N use efficiency and low apparent N losses. Field Crops Research. 209 pp 39 - 46.
Reference ID: 24247
Note: #24247e
Abstract: Drip irrigation under plastic mulch (DIPM) has been used to achieve high maize yields in China, but N use efficiency is often low and N losses are high. Here, we designed a DIPM system with optimal N management to close the maize yield gap with high NUE and low N loss and used it in Northeast China in 2014 and 2015. The amount and timing with optimal N rate (ONR) were designed to close the maize yield gap based on the N requirement. Grain yield using the ONR treatments averaged 13.8 Mg ha^{-1} during 2014 and 2015, which was 90% of the yield potential simulated by the Hybrid-Maize Model. When N treatment was less than the ONR (70% ONR), grain yield decreased from 13.8 to 11.6 Mg ha^{-1}. When additional N fertilizer (130% ONR) was applied, no gain in yield was achieved, but N losses increased significantly from 65 to 121 kg N ha^{-1}. Grain yield was significantly lower in the farmers' typical N practice treatment than that in the ONR treatment. Although 30% more N was applied with farmers' practice, the lowest N use efficiency and greatest N losses were observed. In conclusion, DIPM with optimal N management increased yield potential with high N use efficiency and low N losses in a water-limited region.

[56] B.S. Farmaha, D.B. Lobell, K.E. Boone, K.G. Cassman, H.S. Yang, P. Grassini. (2016). Contribution of persistent factors to yield gaps in high-yield irrigated maize. Field Crops Research. 186 pp 124 - 132.
Reference ID: 24248
Note: #24248e
Abstract: Crop yield gap (Yg) can be disaggregated into two components: (i) one that is consistent across years and is, therefore, attributable to persistent factors that limit

yields, and (ii) a second that varies from year to year due to inconsistent constraints on yields. Quantifying relative contributions of persistent and non-persistent factors to overall Yg, and identifying their underpinning causes, can help identify sound interventions to narrow current Yg and estimate magnitude of likely impact. The objective of this study was to apply this analytical framework to quantify the contribution of persistent factors to current Yg in high-yield irrigated maize systems in western US Corn Belt and identify some of the under-pinning explanatory factors. We used a database containing producer yields collected during 10 years (2004–2013) from ca. 3000 irrigated fields in three regions of the state of Nebraska (USA). Yield potential was estimated for each region-year using a crop simulation model and actual weather and management data. Yg was calculated for each field-year as the difference between simulated yield potential and field yield. Two independent sources of field yield data were used: (i) producer-reported yields, and (ii) estimated yields using a combined satellite-crop model approach that does not rely on actual yield data. In each year (hereafter called 'ranking years'), fields were grouped into 'small' and 'large' Yg categories. For a given category, Yg persistence was calculated by comparing mean Yg estimated for ranking years against mean Yg calculated, for the same group of fields, for the rest of the years. Explanatory factors for persistent Yg were assessed. Yg persistence ranged between ca. 30% and 50% across regions, with higher persistence in regions with heterogeneous soils. Estimates of Yg size and persistence based on producer-reported yields and satellite-model approach were in reasonable agreement, though the latter approach consistently underestimated Yg size and persistence. Small Yg category exhibited a higher frequency of fields with favorable soils and soybean-maize rotation and greater N fertilizer and irrigation inputs relative to the large Yg category. Remarkably, despite higher applied inputs, efficiencies in the use of N fertilizer, irrigation, and solar radiation were much higher in fields exhibiting small Yg. The framework implemented in this study can be applied to any cropping system for which a reasonable number of field-year yield and management data are available.

[57] L.G.J. van Bussel, P. Grassini, J. Van Wart, J. Wolf, L. Claessens, H. Yang, H. Boogaard, H. de Groot, K. Saito, K.G. Cassman, M.K. van Ittersum. (2015). From field to atlas: Upscaling of location-specific yield gap estimates. Field Crops Research. 177 pp 98 - 108.
Reference ID: 24249
Note: #24249e
Abstract: Accurate estimation of yield gaps is only possible for locations where high quality local data are available, which are, however, lacking in many regions of the world. The challenge is how yield gap estimates based on location-specific input data can be used to obtain yield gap estimates for larger spatial areas. Hence, insight about the minimum number of locations required to achieve robust estimates of yield gaps at larger spatial scales is essential because data collection at a large number of locations is expensive and time consuming. In this paper we describe an approach that consists of a climate zonation scheme supplemented by agronomical and locally relevant weather, soil and cropping system data. Two elements of this methodology are evaluated here: the effects on simulated national crop yield potentials attributable to missing and/or poor quality data and the error that might be introduced in scaled up yield gap estimates due to the selected climate zonation scheme. Variation in simulated yield potentials among weather stations located within the same climate zone, represented by the coefficient of variation, served as a measure of the performance of the climate zonation scheme for upscaling of yield potentials. We

found that our approach was most appropriate for countries with homogeneous topography and large climate zones, and that local up-to-date knowledge of crop area distribution is required for selecting relevant locations for data collection. Estimated national water-limited yield potentials were found to be robust if data could be collected that are representative for approximately 50% of the national harvested area of a crop. In a sensitivity analysis for rainfed maize in four countries, assuming only 25% coverage of the national harvested crop area (to represent countries with poor data availability), national water-limited yield potentials were found to be over- or underestimated by 3 to 27% compared to estimates with the recommended crop area coverage of ≥50%. It was shown that the variation of simulated yield potentials within the same climate zone is small. Water-limited potentials in semi-arid areas are an exception, because the climate zones in these semi-arid areas represent aridity limits of crop production for the studied crops. We conclude that the developed approach is robust for scaling up yield gap estimates from field, i.e. weather station data supplemented by local soil and cropping system data, to regional and national levels. Possible errors occur in semi-arid areas with large variability in rainfall and in countries with more heterogeneous topography and climatic conditions in which data availability hindered full application of the approach.

[58] P. Grassini, L.G.J. van Bussel, J. Van Wart, J. Wolf, L. Claessens, H. Yang, Boogaard. H., H. de Groot, M.K. van Ittersum, K.G. Cassman. (2015). How good is good enough? Data requirements for reliable crop yield simulations and yield-gap analysis. Field Crops Research. 177 pp 49 - 63.
Reference ID: 24250
Note: #24250e
Abstract: Numerous studies have been published during the past two decades that use simulation models to assess crop yield gaps (quantified as the difference between potential and actual farm yields), impact of climate change on future crop yields, and land-use change. However, there is a wide range in quality and spatial and temporal scale and resolution of climate and soil data underpinning these studies, as well as widely differing assumptions about cropping-system context and crop model calibration. Here we present an explicit rationale and methodology for selecting data sources for simulating crop yields and estimating yield gaps at specific locations that can be applied across widely different levels of data availability and quality. The method consists of a tiered approach that identifies the most scientifically robust requirements for data availability and quality, as well as other, less rigorous options when data are not available or are of poor quality. Examples are given using this approach to estimate maize yield gaps in the state of Nebraska (USA), and at a national scale for Argentina and Kenya. These examples were selected to represent contrasting scenarios of data availability and quality for the variables used to estimate yield gaps. The goal of the proposed methods is to provide transparent, reproducible, and scientifically robust guidelines for estimating yield gaps; guidelines which are also relevant for simulating the impact of climate change and land-use change at local to global spatial scales. Likewise, the improved understanding of data requirements and alternatives for simulating crop yields and estimating yield gaps as described here can help identify the most critical “data gaps” and focus global efforts to fill them. A related paper (Van Bussel et al., 2015) examines issues of site selection to minimize data requirements and up-scaling from location-specific estimates to regional and national spatial scales.

[59] S.M. Haefele, N.P.M. Banayo, S.T. Amarante, J.D.L.C. Siopongco, R.L. Mabesa. (2013). Characteristics and management options for rice–maize systems in the Philippines. Field Crops Research. 144 pp 52 - 61.
Reference ID: 24251
Note: #24251e
Abstract: In the Philippines, maize (corn) is the second major cereal crop after rice. Around 0.12 million ha of maize are grown in rice–maize (R–M) systems, mostly situated in the lowlands, and the area of this system is growing fast. The objectives of this study were to describe the targeted cropping system, to test several management options that could help to optimize it and reduce the production risk, and to develop a simple nutrient balance as a sustainability indicator. For this, we conducted participatory onfarm trials in Pangasinan province, where about 33,600 ha of yellow maize are grown, mostly in R–M systems. Combined grain yields of the system reached 14 t ha^{-1} in the first year and 21 t ha^{-1} in the second year, depending on the treatment. Yield differences were mostly due to climate-induced stresses in the first year and very favorable conditions in the second year. Varietal choice in rice was an option to reduce production losses by selecting the variety according to average field-specific characteristics (drought-prone, favorable, flood-prone). Balanced fertilizer applications reduced stress-dependent rice yield losses considerably, and helped to maximize grain yield in the favorable season. The rice fertilizer treatment without any application caused lower yields in the subsequent maize crop but the effect was not significant. No effects of field topography on soil characteristics or on grain yields of rice or maize were detected. The nutrient balance indicated the considerable danger of soil nutrient mining in this cropping system, which could aggravate possible trends of declining soil organic matter concentrations in R–M systems that have been shown in previous studies. We concluded that a combination of adjusted management components can reduce production risk and optimize system productivity. To maintain system productivity, it seems most promising to combine different management elements, including balanced NPK fertilizer rates with limited PK mining, recycling of waste products from residue use on the farm as much as possible, and only limited removal of residues from the fields.

[60] K.F. Davis, M.C. Rulli, F. Garrassino, D. Chiarelli, A. Seveso, P. D'Odorico. (2017). Water limits to closing yield gaps. Advances in Water Resources. 99 pp 67 - 75.
Reference ID: 24252
Note: #24252e
Abstract: Agricultural intensification is often seen as a suitable approach to meet the growing demand for agricultural products and improve food security. It typically entails the use of fertilizers, new cultivars, irrigation, and other modern technology. In regions of the world affected by seasonal or chronic water scarcity, yield gap closure is strongly dependent on irrigation (blue water). Global yield gap assessments have often ignored whether the water required to close the yield gap is locally available. Here we perform a gridded global analysis (10 km resolution) of the blue water consumption that is needed annually to close the yield gap worldwide and evaluate the associated pressure on renewable freshwater resources. We find that, to close the yield gap, human appropriation of freshwater resources for irrigation would have to increase at least by 146%. Most study countries would experience at least a doubling in blue water requirement, with 71% of the additional blue water being required by only four crops – maize, rice, soybeans, and wheat. Further, in some countries (e.g., Algeria, Morocco, Syria, Tunisia, and Yemen) the total volume of blue water required for yield gap

closure would exceed sustainable levels of freshwater consumption (i.e., 40% of total renewable surface and groundwater resources).

[61] M.P. Hoffmann, M. Haakana, S. Asseng, J.G. Höhn, T. Palosuo, M. Ruiz-Ramos, S. Fronzek, F. Ewert, T. Gaiser, B.T. Kassie, K. Paff, E.E. Rezaei, A. Rodríguez, M. Semenov, A.K. Srivastava, P. Stratonovitch, F. Tao, Y. Chen, R.P. Rötter. (2017). How does inter-annual variability of attainable yield affect the magnitude of yield gaps for wheat and maize? An analysis at ten sites. Agricultural Systems. pp 1 - 10.
Reference ID: 24253
Note: #24253e
Abstract: Provision of food security in the face of increasing global food demand requires narrowing of the gap between actual farmer's yield and maximum attainable yield. So far, assessments of yield gaps have focused on average yield over 5–10 years, but yield gaps can vary substantially between crop seasons. In this study we hypothesized that climate-induced inter-annual yield variability and associated risk is a major barrier for farmers to invest, i.e. increase inputs to narrow the yield gap.
We evaluated the importance of inter-annual attainable yield variability for the magnitude of the yield gap by utilizing data for wheat and maize at ten sites representing some major food production systems and a large range of climate and soil conditions across the world. Yield gaps were derived from the difference of simulated attainable yields and regional recorded farmer yields for 1981 to 2010. The size of the yield gap did not correlate with the amplitude of attainable yield variability at a site, but was rather associated with the level of available resources such as labor, fertilizer and plant protection inputs. For the sites in Africa, recorded yield reached only 20% of the attainable yield, while for European, Asian and North American sites it was 56–84%. Most sites showed that the higher the attainable yield of a specific season the larger was the yield gap. This significant relationship indicated that farmers were not able to take advantage of favorable seasonal weather conditions. To reduce yield gaps in the different environments, reliable seasonal weather forecasts would be required to allow farmers to manage each seasonal potential, i.e. overcoming season-specific yield limitations.

[62] E.A. Abdalla, A.K. Osman, M.A. Maki, F.M. Nur, S.B. Ali, J.B. Aune. (2015). The Response of Sorghum, Groundnut, Sesame, and Cowpea to Seed Priming and Fertilizer Micro-Dosing in South Kordofan State, Sudan. Agronomy. 5 pp 476 - 490.
Reference ID: 24254
Note: #24254e
Abstract: Abstract: This study was undertaken with the objective of evaluating micro-dosing of mineral fertilizer combined with seed priming in sorghum, groundnut, sesame, and cowpea. On-station and on-farm trials were conducted for two consecutive seasons (2009/2010 and 2010/2011) at Al-Tukma village (12°00′57.60″ N and 29°46′12.15″ E) in South Kordofan State, 15 km southeast of Dilling city. Heavy cracking clay soil is the dominant soil type in the region with low fertility. The experiments for each crop consisted of two priming levels (primed seeds vs. non-primed) and four micro-doses of NPK mineral fertilizer (0, 0.3, 0.6 and 0.9 g per planting pocket or hole). On-farm trials in 15 fields consisted of control, seed priming, and seed priming + micro fertilizer (0.3 g/planting hole). Data collected included plant vigor, stand count, plant height, grain and straw yield, seed weight, and other relevant agronomic traits. This study shows that it is possible to increase productivity of sorghum, sesame, groundnut, and cowpea in the semi-arid cracking clay of South Kordofan State at a low cost and with a moderate risk for farmers through seed priming

and micro-dosing of fertilizers. Seed priming combined with micro-dosing NPK mineral fertilizer of 0.9 g was the best treatment for plant establishment, seedling vigor, grain yield, and hay yield in sorghum and groundnut, whereas the combination of seed priming and 0.3 g micro-doing of fertilizer was the best in sesame. Seed priming and micro-dosing of fertilizer of 0.6 g was the best combination for cowpea. On-farm trial results indicated that priming alone and priming combined with fertilizer application significantly increased the yields of sorghum, groundnut, and cowpea over the control ($P = 0.01$). Of the crops tested, groundnut responded most favorably to micro-dosing and seed priming, with a value to cost ratio (VCR) of 26.6, while the highest VCR for sorghum, sesame, and cowpea was 12.5, 8.0 and 4.4, respectively. For the best productivity and profitability, we recommend using seed priming in combination with the micro-dosing of 0.9 g/hole of 15:15:15 NPK fertilizer for sorghum and groundnut, of 0.3 g/hole for sesame, and of 0.6 g/hole for cowpea grown in the semiarid South Kordofan State of Sudan.

[63] N.K. Sekhon, C.B. Singh, A.S. Sidhu, S.S. Thind, G.S. Hira, D.S. Khurana. (2008). Effect of straw mulching, irrigation and fertilizer nitrogen levels on soil hydrothermal regime, water use and yield of hybrid chilli. Archives of Agronomy and Soil Science. 54(2) pp 163 - 174.
Reference ID: 24255
Note: #24255e
Abstract: In northern India, chilli is transplanted in the hot and dry months of February and March when the crop depends upon irrigation water for canopy establishment. Hybrid chilli may require more irrigation water and fertilizer N due to its higher yield potential but the problem of the depleting groundwater table in the region necessitates developing a technique for reducing water requirement. Rice residue mulching can lower soil temperature and reduce evaporation losses from soil. An experiment was conducted on sandy loam soil for three years to evaluate the effect of rice straw mulch @ 6 Mg ha^{-1} on yield, fertilizer N and irrigation water requirement of hybrid chilli. Maximum and minimum soil temperatures at 50 mm depth during 2003 were lowered up to 8.9 and 2.2^{o}C, respectively, by rice residue mulching. Mulching improved fresh red chilli yield by 2.4 Mg ha^{-1} and required 120 mm less irrigation water. Substantial yield increase with mulching may be attributed to favourable soil hydrothermal regime as evident from lower soil temperature, higher profile moisture (12 mm) and 13.5 Mg ha^{-1} lower weed biomass. Chilli yield obtained with 45 kg N ha^{-1} with mulch was the same as that of 75 kg N ha^{-1} without mulch. Ascorbic acid content decreased with lower irrigation frequency but was significantly higher without mulch.

[64] S. Iqbal, H. I. Tak, A. Inam, A. Inam, S. Sahay, S. Chalkoo. (2015). Comparative Effect of Wastewater and Groundwater Irrigation Along with Nitrogenous Fertilizer on Growth, Photosynthesis and Productivity of Chilli (*Capsicum annuu*m L.). Journal of Plant Nutrition. 38(7) pp 1006 - 1021.
Reference ID: 24256
Note: #24256e
Abstract: A study was made in the net house of Plant Physiology, Department of Botany, Aligarh Muslim University, Aligarh to study the comparative effect of wastewater and groundwater along with three different rates of nitrogen (N) of 0, 30, and 60 kg ha^{-1} on growth, physiology and yield of two varieties of chilli cv. ‘G4’ and ‘Pusa Jawala’. Wastewater irrigation resulted significant increase in shoot and root length, fresh weight, dry weight, leaf number and area, net photosynthetic rate (PN), stomatal conductance (gs), water use efficiency (WUE), chlorophyll content, and yield.

The physio-chemical parameters of wastewater met the irrigational characteristics, being well within the permissible limit as outlined by the Food and Agriculture Organization. Among the nitrogen doses 30 kg ha^{-1} N along with wastewater proved best for the growth and yield. Thus it may be concluded that wastewater reduced the demand of fertilizers and it may be used for the cultivation of chilli.

[65] S. Chalkoo, S. Sahay, A. Inam, S. Iqbal. (2014). Application of Wastewater Irrigation on Growth and Yield of Chilli Under Nitrogen and Phosphorus Fertilization. Journal of Plant Nutrition. 37(7) pp 1139 - 1147.
Reference ID: 24257
Note: #24257e
Abstract: In the present study a pot experiment was carried out in 2009 where different nitrogen (N) and phosphorus (P) combinations with soil (N0P0, N20P30, N20P60, N40P30, and N40P60) were taken into pots. Nutritional growth and yield such as length, fresh and dry weight, leaf area, leaf number, pedicle length, fruit length, fruit number, and seed content were significant at $P \leq 0.05$. Evaluation of data reveals that plant growth parameters and yield of chilli significantly increased in wastewater treatment with 20 kg ha^{-1} N and 30 kg ha^{-1} P in comparison to groundwater treatments. It was also found that higher dose of fertilizers with wastewater decreases plant growth and development of *Capsicum annuum* L. Thus it was concluded that wastewater reuse as a source of nutrient may not only solves the problems of the more use of chemical fertilizers but also decreases the fresh water scarcity in agriculture land.

[66] D.J. Bagyaraj, K.R. Sreeramulu. (1982). Preinoculation with VA mycorrhiza improves growth and yield of chilli transplanted in the field and saves phosphatic fertilizer. Plant and Soil. 69 pp 375 - 381.
Reference ID: 24258
Note: #24258e
Abstract: Nursery beds were inoculated with four different VA mycorrhizal fungi, *Glomus fasciculatus* and three local isolates I_4, I_6 and I_{14}, and mycorrhizal seedlings were transplanted to field plots with two levels of phosphatic fertilizer. Of the fungi studied, isolate I_4 increased significantly growth, P and Zn nutrition, flowering, yield of chilli plants and also the ascorbic acid content of green chillies. Yield of I_4 inoculated plants given half the recommended level of P was slightly more than the uninoculated plants given the full level of phosphatic fertilizer. This suggests the possibility of extending the simple technology of inoculating nursery beds with mycorrhiza to farmers in order to improve plant growth and save phosphatic fertilizer.

[67] S. Das, K.C. Teja, B. Duary, P.K. Agrawal, S.S. Bhattacharya. (2016). Impact of nutrient management, soil type and location on the accumulation of capsaicin in *Capsicum chinense* (Jacq.): One of the hottest chili in the world. Scientia Horticullturae. 213 pp 354 - 366.
Reference ID: 24259
Note: #24259e
Abstract: *Capsicum chinense* (Jacq.) cv. Borbhut a highly pungent and strictly endemic landrace is found in Northeast India. Information regarding scientific cultivation of this crop is not available. In the present investigation, we formulated a few organic based integrated nutrient management schemes to standardize the pungency and hotness of the crop in two widely apart locations. Here we assess the impact of the management schemes on capsaicin accumulation in *C. chinense* grown

in two types of soil (alluvial and lateritic) falling in two states of India (Assam and West Bengal). Some vital nutritional (crude protein, fibre, sugar and acid contents) and phytochemical features (β-carotene, lycopene) were also evaluated. Chilies grown in Assam soil (alluvial) exhibited significantly higher capsaicin content and pungency than those grown in the West Bengal soil. Application of vermicompost alone resulted in higher fruit yield, soluble sugar, protein, fibre, and lycopene contents in plants of Assam; whereas in West Bengal the maximum fruit yield and nutritional attributes were observed in plants grown under NPK + Vermicompost. However, vermicompost based nutrient management scheme efficiently elevated the pungency level in “Borbhut” irrespective of soil types.

[68] P.J.S. Cramer. (1950). A Comparison Between Oilpalms and Coconut (ii). The Planter. 26 pp 389 - 398.
Reference ID: 24260
Note: S Serial < #24260e (note: this is continuation of #23741 and will continue in #24261)

[69] P.J.S. Cramer. (1950). A Comparison Between Oilpalms and Coconuts (iii). The Planter. 26 pp 429 - 431.
Reference ID: 24261
Note: S serial > #24261e (note: this is a continuation from #23741 and #24260)

[70] R.B. Jagoe. (1952). "Deli" Oil Palms and Early Introductions *Elaeis Guineensis* to Malaya. The Planter. 28 pp 249 - 255.
Reference ID: 24262
Note: S serial > #24262e (note this article was published in Malaysian Agriculture Journal #2712)
Abstract: Introduction: Whether the West African oil palm, *Elaeis guineensis*, is an indigenous African species or an introduced one is a matter of debate, for, although it is widely established, as its name implies, in the tropical West Africa, the genus is much better represented in South America; indeed this latter region contains nearly all the Cocoineeae, to which order *Elaeis* belongs. It is, however, very well established in the tropical zone of Africa, and is of importance in the peasant economy of that region.

[71] J.F. Twitchin. (1956). Palm Oil Machinery: Crude Oil Station and Clarification. The Planter. 32 pp 13 - 17.
Reference ID: 24263
Note: S serial > #24263e
Abstract: On leaving the presses, the crude oil is led through a system of pipes or troughs to the crude oil collection station. The approximate average composition of crude oil is 50% palm oil, 40% water and 10% dirt, sand, fibre and other solid particles.

[72] J.F. Twitchin. (1956). Palm Oil Machinery: The Kernel Recovery Plant. The Planter. 32 pp 82 - 88.
Reference ID: 24264
Note: S serial < #24264e
Abstract: When the nuts leave the depericarpers, assuming an efficient machine, they should be polished and free from dirt and other material, such as broken pieces of bunch and immature fruits. They will have received a partial drying as well, but this will vary according to the throughput of the plant in relation to the capacity of the machine.

[73] De Bergcultures. (1956). Oil Palm Stem Rot in Sumatra. The Planter. 32 pp 94 - 95.
Reference ID: 24265
Note: S serial < #24265e
Abstract: Since the war, the stemrot-disease caused by the fungus, *Ganoderma Incidum* (Polyporaceae), has spread alarmingly in the oilpalm estates on the East Coast of Sumatra.

[74] E.M. Rogers. (2003). Diffusion of Innovations (5th eds.). pp 1-551 - 551.
Reference ID: 24266
Note: S GENERAL #24266
Abstract: In this renowned book, Everett M. Rogers, professor and chair of the Department of Communication & Journalism at the University of New Mexico, explains how new ideas spread via communication channels over time. Such innovations are initially perceived as uncertain and even risky. To overcome this uncertainty, most people seek out others like themselves who have already adopted the new idea. Thus the diffusion process consists of a few individuals who first adopt an innovation, then spread the word among their circle of acquaintances—a process which typically takes months or years. But there are exceptions: use of the Internet in the 1990s, for example, may have spread more rapidly than any other innovation in the history of humankind. Furthermore, the Internet is changing the very nature of diffusion by decreasing the importance of physical distance between people. The fifth edition addresses the spread of the Internet, and how it has transformed the way human beings communicate and adopt new ideas.

[75] IPNI. 2018. Planters' Diary 2018.
Reference ID: 24267
Note: S 36 #24267

[76] Y. Zimmer, K. Ericsson. (2017). Understanding Agriculture Worldwide: Cash Crop. Cash Crop. Germany. pp 1 - 40.
Reference ID: 24268
Note: S 13 #24268

[77] A. Gruere, P. Heffer, M. Prud'homme. (2017). Short-term Outlook at World Fertilizer Demand and Supply 2016/17 - 2018/19. IFA Strategic Forum, Zurich, Switzerland 14 - 15 November 2017. Zurich, Switzerland. IFA.
Reference ID: 24269
Note: #24269e

[78] A. Gruere, M. Prud'homme. (2017). Medium-Term Fertilizer Outlook: 2017 - 2021. IFA Annual Conference, Marrakech Morocco, 22 - 24 May 2017. Marrakech Morocco. IFA.
Reference ID: 24270
Note: #24270e

[79] A. Gruere, M. Prud'homme. (2016). Medium-Term Fertilizer Outlook 2016 - 2020. IFA Annual Conference, Moscow Russia, 30 May - 1 June 2016. Moscow Russia. IFA.
Reference ID: 24271
Note: #24271e

[80] C.J. Piggott. (1972). Oil Palms, Lalang and Dalapon. The Planter. 48 pp 9 - 12.
Reference ID: 24272
Note: #24272e
Abstract: The use of herbicides in oil palm plantation has increased very considerably over the last ten years. At one time only an occasional spray of sodium arsenite was given to maintain harvesting paths between oil palms, or to reduce the quantity of grass in the circles. Hand work, at very reasonable cost, could keep the remainder of the unwanted vegetation under control. Even the arsenite was cheap.

[81] A. Pramanik. (1972). Prospects for oil palm products in Malaysia. The Planter. 48 pp 32 - 38.
Reference ID: 24273
Note: #24273e
Abstract: By 1974 the production of crude palm oil in Malaysia is estimated to reach 920 000 tons per annum, compared with the 1970 production of about 420 000 tons. It is desirable that Malaysia produces her own refined palm oil, palm kernel oil and fats, these being extensively used as cooking oil, margarines, shortening, vanaspati, detergents, soap, glycerine etc. It would also be possible to produce other end-products at a competitive price for export.

[82] M.H. Nguyen. (2003). Soil potassium dynamics under intensive rice cropping. A case study in the Mekong Delta, Vietnam. pp 1 - 199.
Reference ID: 24274
Note: S 8.2.1.3 #24274 (note: thesis is available in e-copy #15046)
Abstract: Rice cropping has been greatly intensified in many Asian countries during the last decades to meet the increasing demand for food by the increasing population. There is some concern now that the increased crop yields and nutrient withdrawal, in combination with unbalanced fertilization, lead to potassium (K) depletion of the soil and to K deficiency in rice. However, reports about crop response to K fertilizer application in wetland rice cropping systems show conflicting results, and there are no proper guidelines for K management.
This study was set-up to increase the understanding of K budgets of rice cropping systems, and of K dynamics in soil, to be able to develop K management schemes for the various rice cropping systems. The study was carried out in the Mekong Delta of Vietnam, a major rice growing area. Field studies have been carried out to quantify the inputs and outputs of K in various rice cropping systems. Kinetics of K adsorption-desorption and of K fixation release in soil has been studied in the laboratory to understand the behavior of K in soils. Pot experiments have been carried out to study effect of water management, K fertilizer application on soil K pools and K uptake, and examine the rate of changes of various K pools in soil by rice, grown under controlled conditions. Models were used to analyze and predict changes of K pools in soils over time, using rate constants and initial pool sizes as derived from the laboratory and pot experiments.

[83] ISP. (2017). The Planter Vol 93 No 1096 July 2017. 93 pp 467 - 538.
Reference ID: 24275
Note: S serial #24275

[84] H.S. Ooi, S. Kumar. (2017). Investigating the Drop in Oil Extraction Rate during Peak Cropping Month. The Planter. 93(1096) pp 471 - 488.
Reference ID: 24276
Note: #24276e > S serial #24275
Abstract: A study was undertaken to comprehend the technical reasons for a sudden drop in the oil extraction rate (OER) of a palm oil mill in Sabah from around 21 per cent to 18 per cent during the peak crop period in the months of June and July in 2016. Initial investigation was conducted by the mill by processing the fresh fruit bunches (FFB) from own plantation separately and an OER of 21 per cent and a free fatty acid (FFA) content of 2 per cent in the crude palm oil (CPO) was obtained.

[85] N. Kamarudin, I. Abu Seman, M.M. Mohd Masri, H. Rusli. (2017). Biosecurity Planning and Mitigation of Devastating Pests and Diseases for Oil Palm in Malaysia. The Planter. 93(1096) pp 489 - 497.
Reference ID: 24277
Note: #24277e > S serial #24275 (note: reproduced from the 13th ISP National Seminar 2017 Book,"100 Years of Oil Palm: Surging Forward"
Abstract: Oil palm is the major commodity for Malaysia. Currently, there are relatively few pests and diseases affecting oil palm in Malaysia and South East Asia region. Although plagued by several indigenous pests and diseases like bagworms, rhinoceros beetle and Ganoderma basal stem rot disease, the region is still free from other devastating oil palm diseases. However, there are increased risks to the Malaysian oil palm industry due to globalisation of trade and the diversity of plants and plant products entering Malaysia.

[86] IPNI. 2016. Research With Impact - Potassium Fertilizer Research is Reviving Potato Production in China. USA. NM02. (NM02).
Reference ID: 24278
Note: #24278e
Abstract: THE CHALLENGE:
China is the largest global potato producer and Inner Mongolia (IMAR) is one of the country’s major potato-growing regions. In IMAR, potatoes are important as both a staple food and a source of income, with potato sales accounting for more than half of rural household earnings. Potato farmers generally earn a higher profit from growing potatoes, compared with cereal crops or legumes.
Potatoes remove large amounts of potassium (K) from the soil during harvest (up to 720 kg K_2O/ha). Gradual depletion of native soil K reserves by crop harvest, accompanied by insufficient K replacement through fertilization, has led to a decline in the once-adequate soil K supply. Without proper K fertilization, a reduction in potato yield, quality, and farmer profitability has been observed.

[87] IPNI. 2014. Research With Impact - Improved 4R Nitrogen Management Leads to Reduced Nitrous Oxide Emissions. USA. GBL64. (GBL64).
Reference ID: 24279
Note: #24279e
Abstract: THE CHALLENGE:
Nitrogen fertilizer has been identified as a significant source of agricultural greenhouse gas emissions. In particular, nitrous oxide is a potent greenhouse gas with a heat-trapping potential almost 300 times greater than carbon dioxide. A number of food sustainability groups, environmental advocates, and scientific organizations are working to develop a path for reducing nitrous oxide emissions.

[88] A.T. Mohammed, M.T. Dolmat, Z.Z. Zakaria. (1992). Maximum yield of oil palm, Peninsular Malaysia: yield response and efficiency of nutrient recovery. Yield Potential in Oil Palm: International Society of Palm Oil Breeders(ISOPB). Bangi, Selangor. pp 145 - 153.
Reference ID: 24280
Note: #24280e
Abstract: This paper reports on the maximum yield observed from oil palm fertilizer trials conducted between 1970 and 1980 in various locations in Peninsular Malaysia. The main objective of this paper is to highlight the observed maximum yield achieved from the 1960's planting materials and their estimated efficiency of nutrient recovery in bunch yield. One possible means of assessing fertilizer efficiency is to determine the percentage of nutrient recovery in the harvested crop. In this approach it can be assumed that the nutrients not accounted for are either immobilised in the soil or permanent parts of the palm or are lost from the system. The estimated nutrient recovery from the optimum fertilizer input to achieve maximum yield is calculated as described by Tinker (1989) and is based on estimates of nutrients in the bunch derived from Ng and Thamboo yield response at maximum yield achieved. Limiting factors which explain variation from maximum yield have been described by Foster (1989). It was observed that fresh fruit bunch yields obtained in the control plots of alluvial soils are much higher than that from sedentary soils. As expected, the response towards maximum yield in the sedentary soils is relatively much higher than that of alluvial soils. Consequently, the amount of fertilizer required to achieve maximum yield and its efficiency of nutrient recovery is higher for sedentary soils than alluvial soils. It is assumed that there is a corresponding effect on the nutrient uptake and yield response to achieve maximum yield. Thus, at optimum rates of fertilizer applied, the analysis of variance and partial correlation between yield response and control yield, soil type (alluvial and sedentary soil) and the efficiencies of nutrient recovery could provide some clue as to the nutrient which accounts for most yield response variation from achieving maximum yield. In this respect it was found that efficiency of phosphate recovery significantly contributed to the variation, at least within similar environments of Peninsular Malaysia. For highly intensive agriculture, such as oil palm, it is most relevant to focus on fertilizer efficiency at the point of maximum yield.

[89] T. Satyanarayana. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 7: Human Health is Connected to Soil Potassium Fertility. 4(7) pp 1 - 2.
Reference ID: 24281
Note: #24281e
Abstract: Potassium (K) application to crops in India is insufficient to fulfil the dietary requirement of the population, which is often overlooked in a quantity-centric crop production approach.

[90] T. Jensen. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 6: Making Use of Foliar Nutrient Applications. 4(6) pp 1 - 2.
Reference ID: 24282
Note: #24282e
Abstract: Foliar applications are considered first when an unexpected nutrient deficiency is confirmed by crop sample analysis early in the growing season.

[91] T.M. Maaz. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 5: Nitrogen Fertilizer Recommendations: How can we improve the guesstimate game? 4(5) pp 1 - 2.
Reference ID: 24283
Note: #24283e
Abstract: Shifts in nitrogen use efficiency of newer varieties and the adoption of site-specific 4R nutrient management practices (i.e., the right source, right time, right rate, right time) gives us a reason to revisit how we make recommendations.

[92] R. Mikkelsen. 2017. Plant Nutrition Today - Winter 2017 Issue 4 No 4: Soil Nutrient Mining: Good Or Bad? 4(4) pp 1 - 2.
Reference ID: 24284
Note: #24284e
Abstract: The key to managing soil nutrient mining is to understand the balance between inputs and outputs.

[93] Y. Zimmer. (2017). Cost Competitiveness of Oilseeds Production in Major Exporting Countries. PIPOC 2017: Agriculture, Biotechnology & Sustainability Vol 2 - Treasuring the Past, Charting the Future. Kuala Lumpur, Malaysia. Agri benchmark.
Reference ID: 24285
Note: #24285e

[94] H. Sugianto. 2012. Maksimalisasi Produksi Tandan Buah Segar Tanaman Kelapa Sawit (*Elaeis guineensis* Jacq.) Melalui Implementasi Best Management Practice. Institut Pertanian Stiper. Yogyakarta. Master of Plantation Management. pp 1 - 40. Institut Pertanian Stiper Yogyakarta.
Reference ID: 24286
Note: #24286e
Abstract: Peningkatan populasi umat manusia yang diperkirakan akan mencapai 9,2 miliar pada tahun 2050 akan menyebabkan menurunnya ketersediaan lahan pertanian yang produktif. Seiring dengan peningkatan populasi tersebut, kebutuhan akan pangan juga meningkat. Peningkatan produksi bisa dilakukan dengan sistem ekstensifikasi ataupun intensifikasi. Ekstensifikasi akan berat diterapkan, karena ketersediaan lahan yang semakin menipis. Intensifikasi merupakan pilihan terakhir di dalam upaya untuk memenuhi kebutuhan pangan dunia, dalam hal ini minyak nabati. Intensifikasi merupakan upaya untuk meningkatkan produksi dengan menerapkan kultur teknis dan manajemen yang terbaik, yang lebih dikenal sebagai Best Management Practice. Semua input yang diperlukan di dalam upaya pencapaian produksi yang optimal harus diberikan.
Judul dari Tesis ini adalah “Maksimalisasi Produksi Tandan Buah Segar Tanaman Kelapa Sawit (*Elaeis quinensis* Jacq.) Melalui Implementasi Best Management Practice PT. Sungai Rangit, Sampoerna Agro, Tbk”, penelitian berlangsung selama 43 bulan (Juni 2007-Desember 2010).
Metode analisis yang digunakan adalah Relatif Agronomy Index (RAI) yaitu dengan membandingkan nilai tengah dari perlakuan (BMP) dengan kontrol (Estate Practice) dan dikali dengan 100%. Hasil yang diperoleh merupakan gambaran dari efek perlakuan yang diberikan, apabila hasilnya > 100%, berarti perlakuan berdampak positif, apabila hasilnya = 100%, berarti perlakuan tidak berpengaruh dan apabila hasilnya < 100%, berarti perlakuan yang diberikan berdampak negatif.
Hasil penelitian memperlihatkan bahwa implementasi BMP dapat meningkatkan produksi tandan buah segar sebesar 24% yang merupakan kontribusi dari jumlah

tandan sebesar 15% dan berat tandan rata-rata sebesar 8%. Demikian juga untuk kandungan unsur hara daun, yaitu N, P dan K juga lebih baik, namun kandungan Mg dan Ca cendrung menurun. Hal ini dikarenakan pada blok BMP diberi janjangan kosong sebesar 40 ton ha-1.
Hasil analisis tandan dari 1.704 sampel juga menunjukan bahwa pada blok BMP lebih rendah 5,6 % jika dibandingkan dengan blok kontrol. Namun produksi minyak (kg CPO ha-1 lebih tinggi 17% sebagai dampak dari peningkatan produksi tandan buah segar.

[95] E. Lunik, Y. Zimmer, X. Hu, J. Bing. (2016). Farmers in northeast China look for profitable alternatives to corn. pp 1 - 8.
Reference ID: 24287
Note: #24287e
Abstract: Finally, after nearly a decade of stockpiling corn and other grains, China has laid out plans to reduce its stocks and simultaneously its corn acreage. Instead, the government is encouraging farmers to plant other feed crops such as corn silage, sorghum, and soybeans to supply a growing domestic meat and dairy sector and lessen dependency on feed imports. Likewise, farmers are frustrated with low corn profitability, but do the other crops promise more money in the pocket at the end of the season? In this article, we will look at the evolution of corn in Heilongjiang province (part of the northeast China “Corn Belt”) as a case study based on expert interviews and farmer focus groups for how this important shift in policy is affecting Chinese growers in the short run.

[96] H. Peterson. 2018. Plant Nutrition Today - Spring 2018 Issue 1 No 2: Optimizing Phosphorus Use Efficiency with Nutrient Balances. 1(2) pp 1 - 2.
Reference ID: 24288
Note: #24288e
Abstract: When combined with soil testing or water quality data, nutrient balances can be a valuable tool for determining which management strategies will be effective for meeting production or nutrient loss reduction goals.

[97] T.M. Maaz. 2018. Plant Nutrition Today - Spring 2018 Issue 1 No 3: How Enhanced-Efficiency Nitrogen Fertilizer Can Work for You. 1(3) pp 1 - 2.
Reference ID: 24289
Note: #24289e
Abstract: The goal of any enhanced-efficiency nitrogen fertilizer is to supply enough nitrogen when and where the plant needs it. However, not all enhanced-efficiency fertilizer function the same way.

[98] T.S. Murrell. 2018. Plant Nutrition Today - Spring 2018 Issue 1 No 1: Plant Availability of Potassium in Soil Minerals: What's Happening Near the Roots? (1)1.
Reference ID: 24290
Note: #24290e
Abstract: Future improvements in the accuracy and precision of (soil and plant tissue) tests will need to consider how plant varieties differ in their abilities to acquire K.

[99] P.S. Bindraban, C.O. Dimkpa, S. Angle, R. Rabbinge. (2018). Unlocking the multiple public good services from balanced fertilizers. Food Security. pp 1 - 13.
Reference ID: 24291
Note: H 21 #24291e
Abstract: Fertilizers produce over half of the world’s food and permit less

encroachment into pristine lands. Yet, the low uptake efficiency by crop plants causes nutrient losses that drive global change. Mitigating measures have been insufficient to address the problems, and policy interventions, NGO involvement, and R&D investments have been too insignificant to transform the fertilizer sector. Here, we discuss the contribution of balanced mineral fertilizers to increasing the nutritional value of crop produce to improve human nutrition and health; healthier plants to reduce biocide use; plant robustness to enhance tolerance to abiotic stresses; and increased metabolite production to improve taste and shelf-life. We reflect on raising awareness about these multiple fertilizer-based public good services for realizing several Sustainable Development Goals which can be achieved through a comprehensive nutrient assessment to catalyze transformation in research, policy and industry.

[100] P. Lashermes. (2018). Achieving sustainable cultivation of coffee. pp 1 - 392.
Reference ID: 24292
Note: S 8.1.5 #24292
Abstract: Coffee is one of the most widely traded commodities in the world. Coffee cultivation faces a number of challenges including over reliance on a relatively small number of varieties vulnerable to a range of abiotic and biotic stresses as well as increasing expectations of quality amongst consumers. These challenges are addressed by this volume.
Part 1 looks at advances in understanding plant physiology and ensuring genetic diversity. These provide the basis for summarising developments in breeding improved varieties of Arabica and Robusta coffee. The second part of the book reviews our understanding of the chemical composition, sensory properties and potential nutraceutical benefits of coffee.
With its distinguished editor and international range of expert authors, this volume will be a standard reference for coffee scientists, growers and processors

[101] ISP. (2017). The Planter Vol 93 No 1098 September 2017. 93 pp 617 - 676.

[102] C. Bakoume, C. Jannot, O. Ndiaye, M.N. Okoye, E. Konan, E.M.J.J. Ngom, I. Danso, F. Danso. (2017). Oil Palm Development in Africa. The Planter. 93(1098) pp 621 - 641.
Reference ID: 24294
Note: #24294e > S serial #24293
Abstract: It was reported in 2013 that all African countries were net importers of vegetable oils. Imports of palm oil and soybean oil alone represented 123 per cent of the continent's total production of oils and fats and were forecasted to grow. Since the last decade, countries from the African oil palm belt have been firmly determined to raise Africa's production of palm oil not only to ensure a sufficiency of oils and fats for its populations, but also to regain its share in the world market for vegetable oils.

[103] J.S. Tan, Y.P. Lee, S. Mohd Na'Aim, A. Haryati, L.J. Leao, A.R. Muhamad Farid, K. Suthashinikisan, Y.Y. Kwan, S.A. Sharifah Shahrul Rabiah. (2017). Five Decades of Oil Palm Breeding in FGV and Moving Forward. The Planter. 93(1098) pp 647 - 657.
Reference ID: 24295
Note: #24295e > S serial #24293 (Reproduced from the 13th ISP National Seminar 2017 Book, "100 years of Oil Palm: Surging Forward"
Abstract: Felda Global Ventures (FGV) embarked in oil palm plantations more than six decades ago when it was first incorporated in 1956 and initiated oil palm breedings

two decades later. After five decades of oil palm breeding, FGV has emerged as the number producer of oil palm planting material. The breeding programme has yielded new varieties (FGV-3-way) that are not only high yielding but also carry interesting characteristics such as more compact and thus suitable for higher density planting and are tolerant to drier weather conditions. Additionally genomics technology has given rise to screening and genotyping tools leading to the identification of Ganoderma tolerant planting material (GT1).

[104] E.I. Wiloso, C. Benson, R. Heijungs. (2015). Methodological issues in comparative life cycle assessment: treatment options for empty fruit bunches in a palm oil system. International Journal of Life Cycle Assessment. 20 pp 204 - 216.
Reference ID: 24296
Note: #24296e
Abstract: Purpose Palm oil systems generate substantial amounts of biomass residues which are, according to best agricultural practices, preferably returned back to plantation in order to maintain soil fertility. However, there are often variations in this practice. Differences in economic status and possible treatment options for biomass residues determine the preferences to perform life cycle assessment (LCA), leading to a divergence in results. Difficulties when comparing LCA results based on literature are not unusual. The objectives of this paper are to provide guidelines for methodological choices that enable a systematic comparison of diverse scenarios for the treatment and valuation of empty fruit bunches (EFBs) and to explore effects of the scenarios on the environmental performances of a palm oil system.
Methods Eleven scenarios were selected to address the possible EFB valuation and expanded boundaries with reference to the main palm oil system (EFBs applied as mulch, converted to compost or ethanol, treated in an incinerator, and sold as coproducts). The life cycle inventories were modeled based upon an Ecoinvent database. Solutions to multifunctional problems were suggested, including the application of system expansion, substitution, and partitioning, depending upon the nature of the scenarios.
Results and discussion Comparison among LCA results based on the same multifunctional units (crude palm oil + palm kernel oil + palm kernel cake) can be accomplished only in cases where additional coproducts were utilized internally. Based on the global warming impact, the mulch option was preferred. The effect of the avoided process of producing synthetic fertilizers and the assumption that all parts of mulch are available as soil nutrient dominantly determined the final result. These need further verification. This study also demonstrates that the status of EFB as waste or goods is influential on the final results if the EFB is employed externally but has no effect if it is utilized internally.
Conclusions The proposed guidelines provide methodological choices in terms of system boundary, functional unit, and solutions to multifunctional problems. The methods can be used to systematically compare LCA results of different treatment options and valuation of EFB. The preferred alternative for managing this biomass residue could improve environmental performances and orient toward best practices, such as those suggested by the Roundtable on Sustainable Palm Oil (RSPO). Further studies incorporating a site-specific case of palm oil systems would better illustrate the usefulness of the proposed guidelines.

[105] P.D. Jensen, L. Whicker, P. Deutz. (2016). Sustainable Palm Oil Supply Chains: Complexity, Custody and Contention. Proceedings of the 21st Logistic Research Network Annual Conference 2016. pp 1 - 36.
Reference ID: 24297
Note: #24297e
Abstract: Demand for palm oil is strong. It and other products of the oil palm are pervasive in modern society. The sustainability of oil palm cultivation is, however, contested. Different interpretations of sustainability have created conflict at the point of production with perceived Western values conflicting with the perceived needs of palm oil producing countries. This paper contributes to the sustainable supply chain management literature by discussing how stakeholders, with differing objectives, influence behaviour along complex palm oil supply chains. Based on field observation and interviews with these key stakeholders, the paper considers economic, ethical and environmental aspects emerging from efforts to create sustainable palm oil supply chains. In particular, the paper looks at efforts to achieve traceability of supplies and the impacts of such efforts. Insights from this research will help raise awareness of the supply chain dynamics of the palm oil industry, the conflicting challenges faced by downstream buyers and upstream producers, and how well-meaning efforts to support socio-economic development potentially harms efforts to drive sustainable production of oil palm.

[106] S. Y. Chong, C. B. S. Teh, A. N. Ainuddin, E. Philip. (2018). Simple Net Rainfall Partitioning Equations for Nearly Closed to Fully Closed Canopy Stands. Tropical Agricultural Science. 41(1) pp 81 - 100.
Reference ID: 24298
Note: #24298e
Abstract: Many net rainfall models have been developed, but they are often complex, data demanding and usable only for a specific vegetation type. The focus of this study was to develop and validate two simple equations (a two- and a three-coefficient equation) for nearly full canopies of oil palm, rubber and pine trees. Throughfall and stemflow data from seven past studies were used to determine the best-fit coefficients for the two equations. The three coefficient equation was $Pn = Pg \times \exp [- \{0.3443 – (Pg / (58.9748 + Pg)\} \times 0.1639)]$ and the two-coefficient equation was $Pn = 0.7724 \times Pg – 0.5845$ ($R^2 = 0.91$), where Pn and Pg are the net and gross rainfall, respectively. To validate these two equations, field data collections were started. Thirteen rain gauges fit with data loggers were used for rainfall measurement. Three sampled trees were selected randomly for stemflow measurement and one rain gauge was installed at a nearby open area. Two error indices were used as a goodness-of-fit measure for equation accuracy: index of agreement and normalised mean absolute error. The results showed that the two- and three-equation equations performed early equally well. They predicted the net rainfall with an error of between 12 to 23% (ranked as “Fair” to “Good” in terms of overall equation accuracy) and with an index of agreement of more than 90%. The results showed that these two equations can be used fairly accurately to estimate throughfall and net rainfall, and, to a lesser degree, stemflow. Estimation errors occurred most probably because canopy and rainfall characteristics were not taken into account in the two equations.

[107] J. Sayer, J. Ghazoul, P. Nelson, A.K. Boedhihartono. (2012). Oil palm expansion transforms tropical landscapes and livelihoods. Global Food Security. 1 pp 114 - 119.
Reference ID: 24299
Note: #24299e
Abstract: Oil palm is a highly profitable crop adapted to the humid tropics and the area devoted to this crop is likely to expand significantly in the future. It has many environmentally favourable attributes over its full lifecycle. When well managed it has a positive carbon balance and when grown in a landscape mosaic it can play a role in biodiversity conservation. It has driven rapid economic growth in several tropical developing countries and contributed to the alleviation of rural poverty. Abuses during periods of rapid estate expansion into areas of natural forest and on to the lands of poor rural communities have led to criticism by environmental and social activists. With good governance oil palm can make valuable contributions to development and the resulting prosperity may free people to invest in better environmental practices.

[108] IPNI. 2014. Research With Impact - Nutrient Expert® Software Boosts Farm Profitability in Eastern Nepal. NPL-1.
Reference ID: 24300
Note: #24300e
Abstract: THE CHALLENGE:
The Terai region of Nepal is a narrow strip of fertile alluvial land, comprising the most agriculturally productive region of the country. Rice, maize, and wheat are the major food crops of Nepal and they are intensively cultivated in the Terai. Despite their high yield potential, the average yield of these crops has remained stubbornly low. Inadequate nutrition is one of the major reasons that crop yields never approach their potential. Not only is improved productivity of cereal crops in the Terai crucial for Nepalese food security, it is a key to raising the livelihood of over 70% of its population who are directly associated with agriculture.
Balanced and adequate application of plant nutrients is essential to improve cereal productivity in the Terai. However, the lack of capacity of farmers' and their advisers to first estimate and then apply the recommended amounts of plant nutrients to individual fields in this smallholder landscape remains a major barrier.

[109] B. Dubos, V. Baron, X. Bonneau, A. Flori, J. Ollivier. (2017). High Soil Calcium Saturation Limits Use of Leaf Potassium Diagnosis When KCL is Applied in Oil Palm Plantations. Experimental Agriculture. pp 1 - 11.
Reference ID: 24301
Note: #24301e
Abstract: Potassium chloride (KCl) is the most widely used fertilizer in oil palm (*Elaeis guineensis*) plantations and the rates applied are based on interpretation of leaf K contents. When no positive response on leaf K contents can be detected, no optimum content can be established whatever the yield response to KCl rates. We used data from 13 fertilization trials conducted on several continents to study the responses of leaf K, leaf Cl, leaf Ca and yield to KCl rates as a function of the soil properties of each site. We found that the abundance of exchangeable Ca in the soil expressed as a percent of the cation exchange capacity (CEC) was the best soil variable to predict if leaf K content would increase with KCl rates. In addition, we found that the leaf K contents of unfertilized controls at the end of the trials were also correlated with Ca/CEC. This ratio thus appears to be a better index of soil K reserves than soil exchangeable K content.

[110] M. Sacks, S. Gantz, U. Mezuman, L. Peled, P. Imas. (2017). Polyhalite - A Multi-Nutrient Fertilizer Preventing Ca and Mg Deficiencies in Greenhouse Tomatoes under Desalinized Irrigation Water. e-ifc. pp 1 - 7.
Reference ID: 24302
Note: #24302e
Abstract: Greenhouse tomatoes (*Lycopersicon esculentum* Mill.) represent a highly sophisticated agriculture in which all plant requirements are accurately fulfilled and optimized in order to maximize yields and benefits to farmers. This includes balanced mineral nutrition applied through fertigation. Desalinated irrigation water lacks essential nutrients such as sulfur (S), calcium (Ca) and magnesium (Mg), and the incorporation of these to composite fertilizers used for fertigation is costly and, in some cases, impractical. Excess nitrogen (N) application, which often occurs as a result of organic manure supplementation, might reduce produce quality and is known to have serious ecological consequences. Polyhalite, a new mineral fertilizer consisting of S, potassium (K), Mg and Ca, offers an opportunity for pre-planting soil amendment and provides prolonged availability of these nutrients during the whole season.
A case study was conducted to examine the effect of polyhalite at four levels: 0, 1, 1.5, and 2 Mg ha^{-1}, on the performance of on-farm greenhouse tomatoes. Polyhalite prevented Ca and Mg deficiency symptoms that occurred in the control, boosted plant vigor and increased the warm-season's marketable yield by 5-7%. Polyhalite can fully replace all other Ca and Mg liquid fertilizers. It can also provide 33% of the K dose, as well as N-free Mg, thus reducing K-Mg competition and avoiding surplus N nutrition. Given the primality of the present case study and the advantages observed, polyhalite appears as a considerable alternative to other fertilizers. Further research is required in order to combine an optimized polyhalite application with other fertilizer inputs in greenhouse tomatoes.

[111] Y.H. Lu, Y.L. Liao, X. Zhou, J. Nie, J. Xie, Z.P. Yang. (2017). Effect of Combined K and N Application on K Use Efficiency and Balance in Rice-Rice Cropping systems in the Hilly Regions of Hunan Province, China. e-ifc pp 1 - 9.
Reference ID: 24303
Note: #24303e
Abstract: A field experiment under a double-rice cropping system was carried out to study the effects of altered basal potassium (K) application rates (0, 105, and 150 kg K_2O ha^{-1}) using two nitrogen (N) rates (150 and 195 kg N ha–^{1}) on rice yield, K uptake, fertilizer use efficiency, agronomic efficiency, soil K balance, and economic balance. The experiment was carried out on two types of paddy soil in the hilly regions of Hunan Province, China. The early crop yield increased slightly in response to the first increase in K rate, however, further yield increase was obtained only at the higher N rate. A similar response pattern was observed for Research Findings the late crop on the red-yellow soil but not on the yellow soil, where the increase in N rate did not raise the rice yield. Potassium utilization rate was generally low, and it declined with increasing K rates. Potassium agronomic efficiency did not exceed 7 kg grain kg^{-1} K_2O, it declined with increasing K rates but rose in response to an increase in N. Soil soluble K at harvest increased with K rates, however, no significant change was observed in soil exchangeable K. Economic analyses show that the combination of higher K and N rates was the most profitable choice for the early crop, while medium K and lower N rates were the best combination for the late crop. Altogether, these results show that K nutrition is still a focal problem of rice-rice production on paddy soils. They also indicate that the maintenance of soil K balance during the cropping season is the most critical challenge. One recommendation is to examine an alternative approach of

splitting the K application rate along the season, to minimize K seepage. In addition, fertilizer management should be adjusted to local soil characteristics, and a suitable balance among soil macro- and microelements must be preserved.)

[112] R.F. Firmano, A. de Oliveira Jr., C. Castro, F. Vale, L.R.F. Alleoni. (2017). Long-Term Potassium Administration/Deprivation Cycles on Tropical Oxisol: Effects on Soil Fertility and Soybean Performance. e-ifc. pp 1 - 12.
Reference ID: 24304
Note: #24304e
Abstract: Highly weathered soils in the humid tropics generally present low potassium (K) mineral reserves. When K fertilization is restricted, exchangeable K forms tend to run out quickly, hampering crop yield. Furthermore, in the long-term, soil mineral reserves may be affected. A field experiment carried out from 1983 to 2016 at Londrina (Paraná state), evaluated the effect of potassium chloride (KCl) fertilizer rates (0, 40, 80, 120, 160 and 200 kg K_2O ha^{-1} $year^{-1}$) on soybean yield under long cycles of K application (1983-1988; 1995-2008) and K deprivation (1988- 1994; 2008-2014). In October 2015, each plot was divided into Research Findings two, and K fertilizer was reapplied to one half, whilst the second half remained K deprived. The objectives of the present study were to explore soybean nutrition under long-term withheld K fertilization to study the dynamics of K forms in the soil, and to identify an optimum K fertilization rate that would also maintain K reserves in a highly weathered soil. Soil exchangeable K contents (evaluated using the Mehlich-1 and the ion exchange resin methods) corresponded highly with previous K application rates, whilst non-exchangeable K and soil total K were much less affected by treatments.
Soybean responded dramatically to exchangeable K levels at the lower K range and according to Mehlich-1 and the ion exchange resin method, was saturated already above 70 and 110 mg kg^{-1}, respectively. This K residue level was stored in the soil 8 years after an application rate of 120 kg K_2O ha^{-1} and, with no additional fertilizer, was sufficient to support 90% of the maximum yield obtained from the plots where K had been reapplied.
The results indicate that the role of non-exchangeable and structural K forms has been underestimated. Also, a large proportion of the applied K reaches and is stored in the structural K forms, where it remains accessible to plant roots in the longterm. In conclusion, a K application range of 80-120 kg K_2O ha^{-1} is expected to support reasonable growth, development, and yield of soybean on humid tropical Oxisols, whilst preserving future soil fertility. Lower rates would allow sufficient yields in the short-term, but soil fertility might decline with time. Higher application rates would be partially wasted and could even lead to a reduction in yields.

[113] IPI. (2017). e-ifc No 51 December 2017. 51 pp 1 - 52.
Reference ID: 24305
Note: #24305e

[114] B. Dubos, D. Snoeck, A. Flori. (2016). Excessive Use of Fertilizer Can Increase Leaching Processes And Modify Soil Reserves in Two Ecuadorian Oil Palm Plantations. Experimental Agriculture. pp 1 - 15.
Reference ID: 24306
Note: #24306e
Abstract: In the oil palm plantations of Ecuador, two factorial trials (namely CP06 and CP08) were used to assess the effects of N, P and K fertilization on the soil chemical characteristics after 10 years of fertilizer application. The use of ammonia-based

fertilizers has resulted in a drop in soil pH, which has reached 1.2 units in one of the two trials. A drop in cation exchange capacity (CEC) was also found, and a loss of exchangeable cations that probably reflected leaching of excess N as nitrates. The use of KCl enriched the soil in K, which contributed to impoverishment in Ca and Mg. In both trials, the highest N and K application rates had no significant effect on yield in comparison with an intermediate fertilization rate; however, their effects on the fertilized soil significantly increased the risk of N and cation leaching towards the deep soil layers. We also compared the effects of the N, P and K factors on soil properties outside the fertilizer application zone. In both trials, the mineral reserves played a major role in meeting the needs of the control palms, which had not been fertilized for 10 years, as no significant yield drop has been observed except in trial CP06 when no KCl was applied. However, uptake of nutrient in the control plots did not lead to significant impoverishment of the soil.

[115] P. Oettli, S.K. Behera, T. Yamagata. (2018). Climate Based Predictability of Oil Palm Tree Yield in Malaysia. Nature. pp 1 - 13.
Reference ID: 24307
Note: #24307e
Abstract: The influence of local conditions and remote climate modes on the interannual variability of oil palm fresh fruit bunches (FFB) total yields in Malaysia and two major regions (Peninsular Malaysia and Sabah/ Sarawak) is explored. On a country scale, the state of sea-surface temperatures (SST) in the tropical Pacific Ocean during the previous boreal winter is found to influence the regional climate. When El Niño occurs in the Pacific Ocean, rainfall in Malaysia reduces but air temperature increases, generating a high level of water stress for palm trees. As a result, the yearly production of FFB becomes lower than that of a normal year since the water stress during the boreal spring has an important impact on the total annual yields of FFB. Conversely, La Niña sets favorable conditions for palm trees to produce more FFB by reducing chances of water stress risk. The region of the Leeuwin current also seems to play a secondary role through the Ningaloo Niño/ Niña in the interannual variability of FFB yields. Based on these findings, a linear model is constructed and its ability to reproduce the interannual signal is assessed. This model has shown some skills in predicting the total FFB yield.

[116] Z. Cui, H. Zhang, X. Chen, C. Zhang, W. Ma, C. Huang, W. Zhang, G. Mi, Y. Miao, X. Li, Q. Gao, J. Yang, Z. Wang, Y. Ye, S. Guo, J. Lu, J. Huang, S. Lv, Y. Sun, Y. Liu, X. Peng, J. Ren, S. Li, X. Deng, X. Shi, Q. Zhang, Z. Yang, L. Tang, C. Wei, L. Jia, J. Zhang, M. He, Y. Tong, Q. Tang, X. Zhong, Z. Liu, N. Cao, C. Kou, H. Ying, Y. Yin, X. Jiao, Q. Zhang, M. Fan, R. Jiang, F. Zhang, Z. Dou. (2018). Pursuing sustainable productivity with millions of smallholder farmers. Nature. pp 1 - 16.
Reference ID: 24308
Note: #24308e
Abstract: Sustainably feeding a growing population is a grand challenge, and one that is particularly difficult in regions that are dominated by smallholder farming. Despite local successes, mobilizing vast smallholder communities with science- and evidence-based management practices to simultaneously address production and pollution problems has been infeasible. Here we report the outcome of concerted efforts in engaging millions of Chinese smallholder farmers to adopt enhanced management practices for greater yield and environmental performance. First, we conducted field trials across China’s major agroecological zones to develop locally applicable recommendations using a comprehensive decision support program. Engaging

farmers to adopt those recommendations involved the collaboration of a core network of 1,152 researchers with numerous extension agents and agribusiness personnel. From 2005 to 2015, about 20.9 million farmers in 452 counties adopted enhanced management practices in fields with a total of 37.7 million cumulative hectares over the years. Average yields (maize, rice and wheat) increased by 10.8–11.5%, generating a net grain output of 33 million tonnes (Mt). At the same time, application of nitrogen decreased by 14.7–18.1%, saving 1.2 Mt of nitrogen fertilizers. The increased grain output and decreased nitrogen fertilizer use were equivalent to US$12.2 billion. Estimated reactive nitrogen losses averaged 4.5–4.7 kg nitrogen per Megagram (Mg) with the intervention compared to 6.0–6.4 kg nitrogen per Mg without. Greenhouse gas emissions were 328 kg, 812 kg and 434 kg CO_2 equivalent per Mg of maize, rice and wheat produced, respectively, compared to 422 kg, 941 kg and 549 kg CO_2 equivalent per Mg without the intervention. On the basis of a large-scale survey (8.6 million farmer participants) and scenario analyses, we further demonstrate the potential impacts of implementing the enhanced management practices on China's food security and sustainability outlook.

[117] S.K. Behera, R.K. Mathur, A.K. Shukla, K. Suresh, C. Prakash. (2018). Spatial variability of soil properties and delineation of soil management zones of oil palm plantations grown in a hot and humid tropical region of southern India. Catena. 165 pp 251 - 259.
Reference ID: 24309
Note: #24309e
Abstract: Sustainable soil nutrient management with proper understanding of spatial variability of soil properties helps in enhancement of crop productivity and avoiding soil degradation. It has more importance in oil palm plantations, since the area under oil palm cultivation is on rise globally. Moreover, the crop is a nutrient-requiring one and effective nutrient management contributes about 50% of fresh fruit bunch (FFB) production. Therefore, the present study was carried out to assess spatial distribution of soil properties and to delineate soil management zones (MZs) in oil palm plantations of a hot and humid tropical region of India for efficient soil nutrient management. A total of 180 geo-referenced representative soil samples (from 0 to 0.20m depth) were collected from oil palm plantations of Pedavegi and Denduluru mandals of west Godavari district of Andhra Pradesh, India. Collected soil samples were processed and analysed for soil properties like pH, electrical conductivity (EC), soil organic carbon (SOC), available phosphorus (P), available potassium (K), exchangeable calcium (Ca), exchangeable magnesium (Mg), available sulphur (S) and available boron (B). The values of soil properties varied widely with low (7.7%) to moderate (29.0 to 77.4%) coefficient of variations. Semivariogram analysis and ordinary kriging revealed varied spatial distribution pattern with moderate to strong spatial dependence for most of the soil properties. Development of the MZs was carried out by principal component (PC) analysis and fuzzy c-means clustering. Three PCs with eigen values>1 and accounting 60.31% of total variance were used for further analysis. On the basis of fuzzy performance index and normalized classification entropy, three MZs were identified. The MZs differed significantly with respect to studied soil properties. Thus, the study emphasized that the methodology for delineating MZs could be effectively used for site-specific soil nutrient management in oil palm plantations and other crops for maximizing crop production in the study area.

[118] J. Dou Bib, V. Krishna, Z. Alamsyah, M. Qaim. (2018). Land-use change and livelihoods of non-farm households: The role of income from employment in oil palm and rubber in rural Indonesia. pp 1 - 35.
Reference ID: 24310
Note: #24310e
Abstract: Many tropical regions are experiencing massive land-use change that is often characterized by an expansion of oil palm at the expense of forests and more traditional forms of agricultural cropping. While implications of such land-use change for the environment and for local farm households were examined in previous research, possible effects on the livelihoods of non-farm households are not yet well understood. This study analyzes the role of different types of agricultural and non-agricultural employment income for non-farm households in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom. Data from a recent survey show that employment in rubber and oil palm are important livelihood components for non-farm households. Employment in oil palm is more lucrative than employment in rubber, so involvement in the oil palm sector as a laborer is positively associated with total household income. Regression models show that whether or not a household works in oil palm is largely determined by factors related to migration background, ethnicity, and the size of the village area grown with this crop. These results suggest that further expansion of the oil palm area will likely benefit non-farm households through gains in employment income. As non-farm households belong to the poorest segments of the rural population, these benefits should not be ignored when designing policies towards sustainable land use.

[119] IPNI. (2018). Better Crops With Plant Food Vol.102 (2018, No.1). 102 pp 1 - 41.
Reference ID: 24311
Note: #24311e

[120] T. Oberthur, M. Samson, N. Janetski, K. Janetski. (2018). Cocoa Yield under Good Agricultural Practices and 4R Nutrient Management in Indonesian Smallholder Systems. Better Crops With Plant Food. 102(1) pp 3 - 7.
Reference ID: 24312
Note: #24312e
Abstract: Researchers combined a suite of good agricultural practices with 4R-consistent nutrition to achieve a rapid improvement in cocoa bean yield and quality under the guidance of local Cocoa Carers and Monitors. Close monitoring of the soil nutrient balances will be required to sustain this early gain.

[121] F. Yang, D. Wei, P. He. (2018). Estimating Nutrient Uptake Requirements for Soybean. Better Crops With Plant Food. 102(1) pp 8 - 10.
Reference ID: 24313
Note: #24313e
Abstract: Data from field experiments conducted in China were used to assess the relationship between soybean seed yield and nutrient uptake using the QUantitative Evaluation of the Fertility of Tropical Soils (QUEFTS) model. Field validation indicated that QUEFTS could be used to estimate nutrient requirements and help develop fertilizer recommendations for soybean.

[122] G. Barth, E. Francisco, J.T. Suyama, F. Garcia (2018). Nutrient Uptake Illustrated for Modern, High-Yielding Soybean. Better Crops With Plant Food. 102(1) pp 11 - 14.
Reference ID: 24314
Note: #24314e
Abstract: Soybean has grown to be the major crop both in terms of land use and grain production in Brazil. In turn, soybean leads all crops in nutrient consumption. Fields growing high-yielding cultivars are capable of supporting grain yields that are twice the country's average, leading to questions about how these yields impact crop nutrient demand.
Uptake patterns find N and K in highest demand, with K having the fastest acquisition rate (63% of total K uptake occurs before pod filling). Remobilization from leaves, stems, and petioles provides a significant contribution to the total grain content of N, P, K, S, Cu, and Zn, while Mg, B, and Fe only remobilize from leaves.

[123] V. Yakimenko, V. Nosov. (2018). Residual Effect of Potassium Fertilizer on Potato in Western Siberia. Better Crops With Plant Food. 102(1) pp 15 - 17.
Reference ID: 24315
Note: #24315e
Abstract: This long-term field experiment revealed that the residual effect of K fertilization on potato yield may last 4 to 5 years depending on the prior application rates. During this period, the decline in exchangeable and non-exchangeable soil K was considerably larger than crop K removal.

[124] L. Ferreras, G. Magra, A. Saperdi, S. Toresani, M. Boxler, S. Gallo, R. Pozzi, A. Correndo, F. Garcia. (2018). Does Balanced Fertilization Improve Soil Health? Better Crops With Plant Food. 102(1) pp 18 - 20.
Reference ID: 24316
Note: #24316e
Abstract: Crop fertilization not only improves crop yields but also generates positive changes in soil health, which contributes to cropping system sustainability. Balanced fertilization during 12 consecutive years improved soil organic matter, soil microbial population and enzyme activity, and soil aggregate stability in fields with long annual cropping history and coarse soil texture. Similar effects were not found in fields with shorter annual cropping history and finer soil texture.

[125] L. Prochnow, A. Resende, A. Junior, E. Francisco, V. Casarin, P. Pavinato. (2018). Phosphorus Placement for Annual Crops in the Tropics. Better Crops With Plant Food. 102(1) pp 21 - 24.
Reference ID: 24317
Note: #24317e
Abstract: This article discusses principles for optimizing the placement of P in soils of the tropics—looking towards better agronomic, economic, environmental, and social outcomes. General guidelines are offered for short and long-term sustainability.

[126] H. Peterson, L. Baker. (2018). Watershed-Scale Phosphorus Balances to Establish Reasonable Water Quality Expectations. Better Crops With Plant Food. 102(1) pp 25 - 28.
Reference ID: 24318
Note: #24318e
Abstract: Integrating watershed P balances into conventional conservation planning

provides a holistic approach to understanding the nutrient cycling across the landscape, critical for meeting load reduction goals for water quality improvement. To maintain high P use efficiency while ensuring successful crop yields, soil sampling should be encouraged to utilize the available P in areas where additional inputs are not necessary, while ensuring that STP remains above the crop's critical concentration.

[127] J. Rurinda, M.T. van Wijk, P. Mapfumo, K.E. Giller. (2018). Managing Nutrients for Climatic Resilience in African Smallholder Maize Production. Better Crops With Plant Food. 102(1) pp 29 - 32.
Reference ID: 24319
Note: #24319e
Abstract: Soil nutrient management proves critical to increase maize yield under both current and projected climatic conditions. The yield benefits from nutrient management are further enhanced given an early maize planting date.

[128] World Coffee Research. (2018). Arabica Coffee Varieties. pp 1 - 72.
Reference ID: 24320
Note: #24320e
Abstract: Information is power. There are dozens of widely cultivated Arabica coffee varieties around the world, and each is unique in its performance and adaptation to local conditions. This catalogue brings urgently needed information to coffee farmers to help them decide which coffee is best for their situation. Agronomic data—expected yield, nutrition requirements, optimal altitude, disease and pest resistance, etc—about the widespread array of existing cultivated Arabica coffee varieties has never been available in an open-access format before.
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. If a farmer makes a poor decision on variety, the cumulative loss can be huge. Most coffee farmers—who earn their livelihoods based on the decisions they make about what kind of coffee to plant—don't typically have access to transparent information about available varieties and how they differ. The lack of a comprehensive, up-to-date coffee catalogue puts farmers at risk and perpetuates chronically low yields around the globe. The purpose of the catalogue is to lower the risk associated with coffee farming by providing direct information to farmers and other farm renovation or planting decision-makers to enable them to make an informed choice about what variety is best for their circumstances. Choosing the right type of coffee lowers the risk of disease and pest losses, has consequences for quality in the cup, and will be critical for coffee producers facing rapidly changing climates. Choosing the correct variety—one that meets the farmer's goals and needs—can significantly reduce losses due to diseases/pests, increase production volume, and/or increase quality.
In Central America, the coffee leaf rust crisis of 2012 affected nearly 600,000 thousand acres of farmland. Nearly 300,000 coffee farmers needed to replant coffee because of it. To make the best possible decision about what kind of coffee to plant on a farm, producers need to know which varieties will be best adapted to their locations and farming approaches.
Meanwhile, most African coffee-producing countries produce substantially lower volumes of coffee than elsewhere (frequently, less than 500 kg of green coffee per hectare, compared with 1000 kg to 2500kgs per hectare or more). This has profound impacts for farmer livelihoods when farmers are paid per pound of cherry. There is widespread need for replanting with young trees that are resistant to major diseases

and pests (including coffee berry disease, coffee leaf rust, antestia bug and stem borer), and with improved varieties. World Coffee Research believes that over 50% of coffee trees in Africa are more than 50 years old. Nearly all of those are old genetic stock and not well suited for the challenges of the 21st century, changing climates in particular.

[129] K. Osei-Bonsu, K. Opoku-Ameyaw, F.M. Amoah, F.K. Oppong. (2002). Cacao-coconut intercropping in Ghana: agronomic and economic perspective. Agroforestry Systems. 55 pp 1 - 8.
Reference ID: 24321
Note: #24321e
Abstract: In Ghana, shade for cacao (*Theobroma cacao* L.) is becoming a critical issue because of extensive deforestation. Unlike in some other cacao-growing countries, cacao is not grown under the shade of coconut (*Cocos nucifera*) in Ghana. An experiment to compare the merits of four cacao-coconut intercropping systems with the traditional cultivation of cacao under *Gliricidia sepium* shade was undertaken at the Cocoa Research Institute of Ghana. Cacao seedling girth was not affected when intercropped with coconut but was significantly (P = 0.01) reduced when intercropped with *G. sepium*. High density cacao facilitated better early canopy formation. Yield of cacao spaced at 2.5 m triangular (1739 plants ha^{-1}) with coconut at 9.8 m triangular (105 plants ha^{-1}) was significantly higher (P = 0.05) than from the other treatments during 1993/94 to 1995/96. There were no major disease problems associated with intercropping cacao with coconuts. Widely spaced coconuts intercropped with cacao spaced at 3 m × 3 m showed better flowering and gave higher coconut yields, but cacao spaced at 2.5 m triangular under coconuts spaced at 9.8 m triangular was more profitable than the other treatments. Moisture stress was the greatest in cacao system with *G. sepium* shade and this could be responsible for the low yield of cacao in that treatment. It is suggested that properly arranged high density cacao under widely spaced coconuts can be a profitable intercrop system for adoption by cacao farmers in Ghana.

[130] The World Bank. (2017). Russia: Policies for Agri-Food Sector Competitiveness and Investment. pp 1 - 59.
Reference ID: 24322
Note: #24322e
Abstract: Despite advances in agricultural production, TFP, and trade balances, Russia continues to lag behind many comparator countries in measures of crop and livestock productivity. This report aims to provide a vehicle for dialogue with government on agrifood sector collaboration to address this situation. It identifies policy recommendations to address selected challenges and to support the government's aim of attracting investments in the agri-food sector, approached from the point of view that increased productivity will improve the competitiveness of agri-food value chains, result in higher profitability, and encourage more investment, including FDI, in Russian agriculture. In practical terms, this report identifies three areas in which the public sector may be able to use policy and programmatic interventions to spur productivity, competitiveness, investment, and exports: investing in broadening productivity gains in priority sectors, strengthening value chains and value-addition in the food industry, and promoting human capital in rural areas through capacity building in agricultural sciences and farm management to improve labor productivity. Some progress has been made, but more is needed.

[131] Y. Zimer, G. Blatchford. (2017). British Potato 2017. AHDB The Potato Industry Event 2017. Harrogate, UK. Agri Benchmark.
Reference ID: 24323
Note: #24323e

[132] A.K. Srivastava, S.K. Malhotra. (2017). Nutrient Use Efficiency in Perennial Fruit Crops - A Review. Journal of Plant Nutrition. pp 1 - 72.
Reference ID: 24324
Note: #24324e
Abstract: Perennial fruits crops by the virtue of their nutritional qualities have already emerged as a major alternative, cutting short the menacing load on the consumption of traditional monotonous cereal/tuber crop-based diet. Nutrient management based production system of perennial fruit crops is inherently complex to understand due to large variation in nutrient use efficiency (NUE). Current state of diagnosis of nutrient constraints in current season standing crop has minimum efficacy. Therefore, development of production- linked nutrient norms using crop specific index plant parts, needs a thorough revisit at orchard level using conventional basin irrigation versus fertigation. Application of hyperspectral analysis as proximal sensing of nutrient stress has started imparting precision to nutrient constraint diagnosis. On the other hand, the biggest constraint in making soil test ratings more purposeful is the non-redressal of spatial variation in soil fertility in form of soil fertility analogues vis-a-vis fruit crops. Conjoint use of geoinformatics and nutrient experts as decision support tool(s) accommodating site specific nutrient management strategy, newer concept of fertigation such as open field hydroponics and variable rate application as possible improvements in NUE collectively using logical relationship between canopy volume and nutrient requirement, exploiting further the nutrient--harmone and nutrient-microbe (in consortium mode) synergies have yielded definite edge over conventional methods of nutrient management options in fruit crops.

[133] A. Hodge, D. Robinson, A. Fitter. (2000). Are microorganisms more effective than plants at competing for nitrogen? Trends in Plant Science. 5(7) pp 304 - 308.
Reference ID: 24325
Note: #24325e
Abstract: Plant scientists have long debated whether plants or microorganisms are the superior competitor for nitrogen in terrestrial ecosystems. Microorganisms have traditionally been viewed as the victors but recent evidence that plants can take up organic nitrogen compounds intact and can successfully acquire N from organic patches in soil raises the question anew. We argue that the key determinants of ‘success’ in nitrogen competition are spatial differences in nitrogen availability and in root and microbial distributions, together with temporal differences in microbial and root turnover. Consequently, it is not possible to discuss plant–microorganism competition without taking into account this spatiotemporal context.

[134] J.G. Conijn, P.S. Bindraban, J.J. Schroder, R.E.E. Jongschaap. (2018). Can our global food system meet food demand within planetary boundaries? Agriculture, Ecosystems & Environment. 251 pp 244 - 256.
Reference ID: 24326
Note: #24326e
Abstract: Global food demand is expected to increase, affecting required land, nitrogen (N) and phosphorus (P) inputs along with unintended emissions of greenhouse gasses (GHG) and losses of N and P. To quantify these input

requirements and associated emissions/losses as a function of food demand, we built a comprehensive model of the food system and investigated the effects of multiple interventions in the food system on multiple environmental goals. Model outcomes are compared to planetary boundaries for land system change, climate change and the global N and P cycles to identify interventions that direct us towards a safe operating space for humanity. Results show a transgression of most boundaries already for 2010 and a drastic deterioration in the reference scenario for 2050 in which no improvements relative to 2010 were implemented. We defined the following improvements for 2050: reduction of waste, less consumption of animal products, higher feed conversion efficiency, higher crop and grassland yields, reduction of N and P losses from agricultural land and reduction of ammonia (NH_3) volatilization. The effects of these measures were quantified individually and in combination. Significant trade-offs and synergies in our results underline the importance of a comprehensive analysis with respect to the entire food system, including multiple measures and environmental goals. The combination of all measures was able to partly prevent transgression of the boundaries for: agricultural area requirement, GHG emission and P flow into the ocean. However, global mineral N and P fertilizer inputs and total N loss to air and water still exceeded their boundaries in our study. The planetary boundary concept is discussed in relation to the selected variables and boundary values, including the additional necessity of eliminating the dependency of our food production on finite P reserves. We argue that total N loss is a better indicator of the environmental impacts of the global N cycle than fertilizer N input. Most measures studied in this paper are also on the agenda of the United Nations for Sustainable Development, which gives added support to their implementation.