Chapter 1 : GMO crops increase yields, benefit the environment | Genetic Literacy Project

Title. Improving crop yields by the use of dynamite, By. New York central and Hudson River railroad company. Genre. Book Material Type.

Advanced Search Abstract In recent years, agricultural growth in China has accelerated remarkably, but most of this growth has been driven by increased yield per unit area rather than by expansion of the cultivated area. Crop production will become more difficult with climate change, resource scarcity e. To pursue the fastest and most practical route to improved yield, the near-term strategy is application and extension of existing agricultural technologies. This would lead to substantial improvement in crop and soil management practices, which are currently suboptimal. Two pivotal components are required if we are to follow new trajectories. First, the disciplines of soil management and agronomy need to be given increased emphasis in research and teaching, as part of a grand food security challenge. Second, continued genetic improvement in crop varieties will be vital. However, our view is that the biggest gains from improved technology will come most immediately from combinations of improved crops and improved agronomical practices. The objectives of this paper are to summarize the historical trend of crop production in China and to examine the main constraints to the further increase of crop productivity. The paper provides a perspective on the challenge faced by science and technology in agriculture which must be met both in terms of increased crop productivity but also in increased resource use efficiency and the protection of environmental quality. Trends in crop production Increased crop production and yield Over the last 50 years there has been remarkable growth in agricultural production in China. Chinese cereal production has increased steadily from The net increase over this period is In , China was responsible for approximately The success of crop production in China has impacted on both global food supply and on natural resource use and availability and both of these changes have received global recognition. However, over the last few decades the balance has shifted to some extent. From to , total cereal cultivation area decreased by 3. In contrast, the cereal cultivation area increased by 5. Total cereal production in the north increased from Mt in to As a result, the North China Plain and the North-East of China have become important cereal production and food-commodity supply regions. In these regions, however, water availability for agriculture is becoming a major issue for the nation. The increase in total crop production in China has arisen mainly as a result of increases in yield per unit area rather than from increases in the cultivated area. For example, from to there was a 3.

Chapter 2 : Improving crop yields by the use of dynamite, - CORE

Improving crop yields by the use of dynamite. by New York central and Hudson River railroad company. [from old catalog] Publication date Topics Explosives.

Various microbial taxa are currently used as biofertilizers, based on their capacity to access nutrients from fertilizers and soil stocks, to fix atmospheric nitrogen, to improve water uptake or to act as biocontrol agents. Despite the existence of a considerable knowledge on effects of specific taxa of biofertilizers, a comprehensive quantitative assessment of the performance of biofertilizers with different traits such as phosphorus solubilization and N fixation applied to various crops at a global scale is missing. We conducted a meta-analysis to quantify benefits of biofertilizers in terms of yield increase, nitrogen and phosphorus use efficiency, based on peer reviewed publications that met eligibility criteria. Our comprehensive analysis provides a basis and guidance for proper choice and application of biofertilizers. Clair and Lynch, Not surprisingly, sustainable crop production remains a major global challenge and has drawn increasing attention among policy makers, business, and the scientific community Seufert et al. Efforts to mitigate the declining mineral nutrient reserves are currently major topics of research but the perturbance of the global biogeochemical cycles, mainly driven by the use of mineral fertilizers, remains a serious problem Kahiluoto et al. Microbial inoculants, so-called biofertilizers, are a promising technology to reduce the use of conventional inorganic fertilizers. Many of them can serve as biofertilizers as they are able to fix nitrogen N , help to access nutrients such as phosphorus P and N from organic fertilizers and soil stocks, improve drought tolerance, improve plant health or increase salt tolerance Vessey, ; Arora, The effects of biofertilizer applications have often been inconsistent, hindering their widespread adoption by farmers. The reasons can be manifold, such as soil conditions, strain identity, or host genotype. Yet, the long history of research offers a great reservoir to identify key influencing factors. Numerous reviews on microbial inoculants have been published, but quantitative results are scarce. Nevertheless, what is missing is a comprehensive quantitative analysis over all biofertilizers and across all target crops and climatic conditions at global scale. Here, we conducted a quantitative evaluation of the pertinent literature in the form of a meta-analysis. Its objective was to quantify the effect of biofertilizers on the performance indicators crop yield and P and N nutrient use efficiencies. The following hypotheses were addressed: P levels are expected to influence activity and thus effectivity of biofertilizers. Especially phosphate-solubilizing bacteria and AMF are expected to be affected by P levels. Studies were only included when they had conducted pairwise comparison between the application of a biofertilizer to a non-treated control under the same pedo-climatic conditions e. Studies had to report the treatment mean of yields, its standard deviation SD and number of replications n to calculate the different use efficiencies and effect sizes. When fertilizer was applied the amount and type of fertilizer was required to calculate nutrient-use efficiencies for phosphorus P and nitrogen N. Field trials were not included when soils were previously fumigated or heat sterilized to obtain a control without soil biota, because nutrients may be released, soil microbial community disturbed and inoculation success put at risk Smith and Read, a. If data were missing or only supplied in summarized format, authors were contacted to obtain these data. A total of possible studies were identified, were excluded after a first screening for greenhouse studies except three studies with tomato grown under commercial conditions and reviews and again because they did not match eligibility criteria mentioned above see flow diagram in Figure S1. Data Sources One hundred and seventy-one studies see study list in Supplementary Data Sheet S1 proved to be eligible for our meta-analysis enabling us to generate 1, pairwise comparisons. Data Preparation and Descriptive Statistics All data was extracted and compiled in an excel file. If the data were only available in graph format, Plot Digitizer Version 2. The data was structured after biofertilizers, crops and climate. Tables 1 and 4 summarize the characteristics of crop and climate categories for the number of included studies, amount of fertilizer applied and climate representation. If the method was missing it was assumed to be measured in water. Soil pH was later used as a control variable for meta-regression. Database as related to different crop categories, climatic zones and nutrient inputs. Bulk density was only available for 10 studies. For the others bulk density was estimated with the pedo-transfer function Post and Kwon, Soil available phosphorus was calculated to a depth of 30 cm. Yet in many cases the method was not given. Yli-halla state that usually there is a rough agreement between the results obtained with different extraction methods in non-calcareous soils, but in calcareous soils the results of acidic and basic extractants usually have a poor correlation. Hence the values of soil available phosphorus cannot be seen as absolute values but only as an indicator for the real values. Soil available phosphorus was calculated to provide another perspective on phosphorus other than P use efficiency PUE. Since no formula exists to account for available phosphorus from soil and fertilizer we conducted a meta-regression with the sum of soil available P and fertilizer P. Thus, for a comprehensive picture, we provide three different analyses of functional biofertilizer categories to P. Meta-analysis A random-effects model was chosen as the statistical model for the meta-analysis Viechtbauer, b. In a meta-analysis, ideally, independent estimates should be aggregated Borenstein et al. Independence is violated in the cases, where several treatments are compared to the same control. It is likely also violated for the cases where study results over several years from the same comparison plots were not averaged but included separately in the meta-analysis. In both cases, we retained all data because the aim of the meta-analysis was to include as much information as possible. For the second case, N use efficiency NUE and P use efficiency PUE likely depend strongly on the annually different climate conditions, thus rather mitigating dependence. If values were supplied as an average over years, replicate numbers of each year were multiplied by the number of years. The random-effects model assumes that the single effect size depends on the study context and that studies differ in their methods and sample characteristics. As a result, there are different effect sizes among all studies. Since the true effect size and its variance are not known the restricted maximum-likelihood estimator REML was used Viechtbauer, b. Effect Sizes and Their Modeling Effect sizes indicate the magnitude of the effect of the improved practice over the control practice concerning yield responses and nutrient use efficiency Borenstein et al. In this study, the percent increase in dry matter yields was used for comparing yields and raw mean difference was used as effect size measure for PUE and NUE, calculated as the log transformed ratio of the mean. Performance Indicators In this study, we evaluated quantitatively the effects of all categories of biofertilizers on crop yield, PUE and NUE, with a main focus on relative crop yield. Key characteristics of the studies can be found in the Supplementary Data Sheet S2. Yield is defined as harvested dry main product, in form of grains, fruits, tubers or shoots. Dry weight had to be calculated for most studies. If the water content was not available, values were taken from Church and Bowes Church and Bowes, PUE was calculated as the yield increase of dry main product per unit of P fertilizer input, and NUE accordingly as the yield increase per unit N fertilizer input referring to the agronomic efficiency of P and N, respectively Ladha et al. The following formulae were used:

Chapter 3 : Details - Improving crop yields by the use of dynamite, - Biodiversity Heritage Library

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How to Increase Crop Yield Feb 24, The agriculture industry has changed a lot over the past century. After the introduction of DDT , as well as the creation of other chemical pesticides, studies have been done to determine the effects of chemicals on soil fertility and water quality. Research has shown that the very same pesticides used to increase crop yield may in fact do the opposite. This is primarily due to the interference of certain pesticides with nitrification , a key component of plant growth and vitality. Low-yielding Soil The quality of soil has been deteriorating worldwide, lowering crop yields, crop quality, and exacerbating harvest uncertainty. Use of synthetic fertilizers instead of humic substances such as humic acid , which are crucial to soil fertility and plant nutrition, is one of the main causes of deteriorating soil quality. Soil Pathogens Soilborne diseases, usually requiring soil fumigation, can greatly diminish crop yields. Fungi, one of the main causes of soilborne vegetable diseases, can survive for long periods due to its ability to produce resistant chemical structures. In addition, crops grown in a tillage-intensive environment are at a higher risk for disease due to the redistribution of pathogens during fragmenting, moving, and burying operations. Managing and diagnosing disease takes additional time and resources. Poor Water Utilization Reduced supply, poor quality, and higher water costs are a growing concern. Water restrictions are regularly imposed on farmers by state legislators as a result of persistent drought, especially in the western part of the United States. These restrictions have had a negative impact on crop yields. In a world where two billion people lack access to clean water , efficient and sustainable farming practices are key. Then the soil can be treated with the appropriate organic product needed to solve the problem, without the use of synthetic chemicals which can harm the environment and provide only a temporary solution. This is the method BioFlora has used successfully for the past 40 years. This approach, called biotechnology , has been shown to increase crop yields worldwide. Biotechnology provides an alternative to chemical pesticides, helping eliminate millions of pounds of pesticide applications worldwide. In addition, it has encouraged widespread adoption of no-till agriculture, resulting in better conservation of soil and water as well as decreased spread of disease. Other benefits of biotechnology include: Enhanced plant and beneficial bacteria and fungi growth Improved soil ecology, recovery, friability, and fertility Increased microbial diversification, population, and density Decreased plant stress from environmental conditions Increased disease resistance and suppression As you can see, using biotechnology practices for your crops is an efficient and effective way to increase crop yield while maintaining the integrity of soil, so that it continues to produce for years to come. These products are designed to take the natural processes by which crops live and grow, develop them and take them to the next level, nurturing the relationship between crops and soil. Wherever a crop is planted, living and growing, BioFlora will improve the quality of both the soil and the natural biochemical processes at work. As a result, we produce a more enriched, more plentiful crop for a wide variety of growers. This is biotechnology; our biotechnology. The patented organic process to grow and harvest the microalgae is extremely innovative as it utilizes all aspects of plant growth biology in a liquid medium. In addition to improving plant growth, the application of algae has also been shown to suppress soil-borne plant pathogens and repel pests, which eliminate the need for chemical fertilizers and hazardous pesticides. Our process is a patented, quality controlled, organic method, which allows us to produce a concentrated algal solution that is unique to the market. Our proprietary solution is full of polysaccharides, proteins, fatty acids and enzymes that combine with one another to benefit growers and help improve their overall crop production! By adding GOgreen, the benefits of these unique classes of organisms are realized. The most dramatic improvements are achieved when GOgreen is administered at pre-plant, planting and the early stages of the growth cycle. Nonetheless, GOgreen can be applied at any stage of plant growth in just about any soil condition. For a full list of BioFlora products, visit our Products page.

Chapter 4 : Category:Dynamite - Wikimedia Commons

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History of technology Productivity improving technologies date back to antiquity, with rather slow progress until the late Middle Ages. Important examples of early to medieval European technology include the water wheel , the horse collar , the spinning wheel, the three-field system after the four-field systemâ€”see Crop rotation and the blast furnace. The spinning wheel increased the supply of rags used for pulp in paper making, whose technology reached Sicily sometime in the 12th century. Cheap paper was a factor in the development of the movable type printing press , which led to a large increase in the number of books and titles published. Bacon stated that the technologies that distinguished Europe of his day from the Middle Ages were paper and printing, gunpowder and the magnetic compass, known as the four great inventions. The four great inventions important to the development of Europe were of Chinese origin. See also List of Chinese inventions. Mining and metal refining technologies played a key role in technological progress. Much of our understanding of fundamental chemistry evolved from ore smelting and refining, with De Re Metallica being the leading chemistry text for years. The significance of the blast furnace goes far beyond its capacity for large scale production of cast iron. The blast furnace was the first example of continuous production and is a countercurrent exchange process, various types of which are also used today in chemical and petroleum refining. It had the immediate effect of dramatically reducing the energy required to produce pig iron, but reuse of heat was eventually applied to a variety of industries, particularly steam boilers, chemicals, petroleum refining and pulp and paper. Before the 17th century scientific knowledge tended to stay within the intellectual community, but by this time it became accessible to the public in what is called "open science". It contained many articles on science and was the first general encyclopedia to provide in depth coverage on the mechanical arts, but is far more recognized for its presentation of thoughts of the Enlightenment. Economic historians generally agree that, with certain exceptions such as the steam engine , there is no strong linkage between the 17th century scientific revolution Descartes, Newton, etc. Scotland was the first place where science was taught in the 18th century and was where Joseph Black discovered heat capacity and latent heat and where his friend James Watt used knowledge of heat to conceive the separate condenser as a means to improve the efficiency of the steam engine. High productivity growth began during the late 19th century in what is sometimes call the Second Industrial Revolution. Most major innovations of the Second Industrial Revolution were based on the modern scientific understanding of chemistry , electromagnetic theory and thermodynamics and other principles known to profession of engineering. Major sources of productivity growth in economic history[edit] s photograph of barge pullers on the Volga River. Pushing was done with poles and manual pulling using overhanging tree branches. New forms of energy and power[edit] Before the industrial revolution the only sources of power were water, wind and muscle. Most good water power sites those not requiring massive modern dams in Europe were developed during the medieval period. In the s John Smeaton , the "father of civil engineering," significantly improved the efficiency of the water wheel by applying scientific principles, thereby adding badly needed power for the Industrial Revolution. Hydro-power continued to be the leading source of industrial power in the United States until past the mid 19th century because of abundant sites, but steam power overtook water power in the UK decades earlier. Fossil fuel energy first exceeded all animal and water power in The role energy and machines replacing physical work is discussed in Ayres-Warr , Until the late 19th century most coal and other minerals were mined with picks and shovels and crops were harvested and grain threshed using animal power or by hand. Heavy loads like pound bales of cotton were handled on hand trucks until the early 20th century. A young "drawer" pulling a coal tub along a mine gallery. Railroads descended from minecarts. In Britain laws passed in and improved working conditions in mines. Excavation was done with shovels until the late 19th century when steam shovels came into use. Dynamite increased productivity of mining, tunneling, road building, construction and demolition and made projects such as the Panama Canal possible. Steam power was applied to threshing machines in the late 19th century. There were steam engines that moved around on wheels under their own power that were used for supplying temporary power to stationary farm equipment such as threshing machines. These were called road engines, and Henry Ford seeing one as a boy was inspired to build an automobile. With internal combustion came the first mass-produced tractors Fordson c. Tractors replaced horses and mules for pulling reapers and combine harvesters, but in the s self powered combines were developed. Output per man hour in growing wheat rose by a factor of about 10 from the end of World War II until about , largely because of powered machinery, but also because of increased crop yields. Mechanized agriculture One of the greatest periods of productivity growth coincided with the electrification of factories which took place between and in the U. Factory electrification Energy efficiency[edit] In engineering and economic history the most important types of energy efficiency were in the conversion of heat to work, the reuse of heat and the reduction of friction. Conversion of heat to work[edit] Main articles: Steam engine , Timeline of steam power , Thermal power station , and Engine efficiency The early Newcomen steam engine was about 0. Electrical generation was the sector with the highest productivity growth in the U. After the turn of the century large central stations with high pressure boilers and efficient steam turbines replaced reciprocating steam engines and by it took 0. Counting the improvements in mining and transportation the total improvement was by a factor greater than The Newcomen and Watt engines operated near atmospheric pressure and used atmospheric pressure, in the form of a vacuum caused by condensing steam, to do work. Higher pressure engines were light enough, and efficient enough to be used for powering ships and locomotives. Multiple expansion multi-stage engines were developed in the s and were efficient enough for the first time to allow ships to carry more freight than coal, leading to great increases in international trade. By one-third of merchant shipping was diesel powered. Improvements in steam engine efficiency caused a large increase in the number of steam engines and the amount of coal used, as noted by William Stanley Jevons in The Coal Question. This is called the Jevons paradox. Electrification and the pre-electric transmission of power[edit] Further information: Line shaft Electricity consumption and economic growth are strongly correlated. Very large central power stations created economies of scale and were much more efficient at producing power than reciprocating steam engines. Line shafts were the common form of power transmission in factories from the earliest industrial steam engines until factory electrification. Line shafts limited factory arrangement and suffered from high power losses. It was used extensively in the Bessemer process and for cranes at ports, especially in the UK. London and a few other cities had hydraulic utilities that provided pressurized water for industrial over a wide area. Common applications included rock drills and jack hammers. Wire rope systems appeared shortly before electrification. Later heat reuse included the Siemens-Martin process which was first used for making glass and later for steel with the open hearth furnace. Iron and steel below. Today heat is reused in many basic industries such as chemicals, oil refining and pulp and paper, using a variety of methods such as heat exchangers in many processes. In the recovery of kraft pulping chemicals the spent black liquor can be evaporated five or six times by reusing the vapor from one effect to boil the liquor in the preceding effect. Cogeneration is a process that uses high pressure steam to generate electricity and then uses the resulting low pressure steam for process or building heat. Industrial process have undergone numerous minor improvements which collectively made significant reductions in energy consumption per unit of production. Reducing friction[edit] Reducing friction was one of the major reasons for the success of railroads compared to wagons. This was demonstrated on an iron plate covered wooden tramway in at Croydon, U. A party of gentlemen were invited to witness the experiment, that the superiority of the new road might be established by ocular demonstration. Twelve wagons were loaded with stones, till each wagon weighed three tons, and the wagons were fastened together. A horse was then attached, which drew the wagons with ease, six miles in two hours, having stopped four times, in order to show he had the power of starting, as well as drawing his great load. Anti-friction bearings were widely used on bicycles by the s. Electric light extended the work day, making factories, businesses and homes more productive. Electric light was not a great fire hazard like oil and gas light. These roads were crowned to shed water and had drainage ditches along the sides. The lower layers were of small stones that allowed good drainage. Plank roads also came into use in the U. Improved roads were costly, and although they cut the cost of land transportation in half or more, they were soon overtaken by railroads as the major transportation infrastructure. During the English or First Industrial Revolution, supplying coal to the furnaces at Manchester was difficult because there were few roads and because of the high cost of using wagons. However, canal barges were known to be workable, and this was demonstrated by building the Bridgewater Canal , which opened in , bringing coal from Worsley to Manchester. History of rail transport Railroads greatly reduced the cost of overland transportation. It is estimated that by the cost of wagon freight was U. Street railways were soon displaced by motor buses and automobiles after When trucks appeared c. Motorized highway transport also reduced inventories. The high productivity growth in the U. Mechanization Adriance reaper, late 19th century Threshing machine from Steam engines were also used instead of horses. Today both threshing and reaping are done with a combine harvester. Mechanized agriculture[edit] The seed drill is a mechanical device for spacing and planting seed at the appropriate depth. It originated in ancient China before the 1st century BC. Saving seed was extremely important at a time when yields were measured in terms of seeds harvested per seed planted, which was typically between 3 and 5. The seed drill also saved planting labor. Most importantly, the seed drill meant crops were grown in rows, which reduced competition of plants and increase yields. It was reinvented in 16th century Europe based on verbal descriptions and crude drawings brought back from China. Reliable seed drills appeared in the mid 19th century. The threshing machine ca. By the s threshing machines were widely introduced and ultimately displaced as much as a quarter of agricultural labor.

Chapter 5 : How to Increase Crop Yield - BioFlora

Improving crop yields by the use of dynamite, By New York central and Hudson River railroad company. Topics: Explosives.

Chapter 6 : Category:Explosives - Wikimedia Commons

Crop yields are an essential aspect of every farmer's day, impacting how profitable their farmland can be. Learning how to improve crop yields is key to successful farming, and access to new technologies and planting methods has given farmers an opportunity increase crop production - the key to maintaining the long term sustainability of their farm.

Chapter 7 : Improving crop yields by the use of dynamite, - Biodiversity Heritage Library

Improve Soil, Increase Crop Yield To increase crop yield, start from the ground up. Testing soils to determine the cause of declining crop yield is the first step toward finding the source of the issueâ€"whether it's disease, a lack of nutrients, or unproductive soil.

Chapter 8 : Towards - Sustainable Strategies to Increase Crop Yields

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Chapter 9 : Productivity improving technologies - Wikipedia

Improving the recycling of organic manures such as animal and human excreta, crop straw and stalks, and green manure can be an important step towards saving natural resources and, simultaneously, stabilizing and optimizing soil quality in crop production systems.