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# Resource Management for Food, Agriculture, Environment and Health Sustainability

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# Abstract Book

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University of Applied  
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In cooperation with



Society for Sustainable Agriculture and  
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# Introduction

Dear Colleagues,

World population is growing unabated, more so in developing countries of Asia, Africa and Latin America. The world population is expected to be about 8 billion in 2025 and will stabilize at about 10 billion people by 2050. Currently around 1 billion people suffer from hunger and 2 billion children are malnourished due to deficiency of minerals and vitamins. The food production needs to be doubled by 2050 from less land area and shrinking water and other natural resources for meeting the needs of growing world population. This is a biggest challenge to the world food security and daunting task for the scientists, technocrats, agricultural experts, environmentalists and policy planners to achieve the targets while maintaining natural resource base of soils for sustainability of agricultural system.

With advent of green revolution era, world food production has increased many folds during last five decades mainly due to adoption of high yielding, high input requiring semi dwarf varieties of wheat, rice and improved hybrids of maize, sorghum etc. However, intensive irrigation and use of agro chemicals have led to many grey patches on account of secondary salinization, degrading soil health and biotic and abiotic stresses. Consequently, the factor productivity is increasing with lesser input use efficiency. The climate change has further aggravated the situation on account of global warming and lack of climate resilient varieties. Human and livestock health is determined by genetic, epigenetic, environmental & nutritional and stress factors and immunity levels. Therefore, coherence among these should be ensured. The immunity can be modulated by food/feed and environment.

Prudent technologies including plant breeding, biotechnology, agri-technologies for crop production and plant protection can pay dividends. Resource optimization, conservation, increased input use efficiency, development of crop varieties with enhanced resilience and tolerance to biotic and abiotic stresses are key deterministic factors for higher crop production, productivity, access to food at affordable prices, profitability of farming systems and elements of food security, environment and health sustainability.

Thus, genetic options and management approaches are called for to meet the challenge. This has become all the more important in wake of Ukraine war led crisis in terms of declining resources, hiking prices for food and energy, migration problems and environment and health concerns.

Keeping above facts and pious goals in view, the International Foundation for Sustainable Development in Africa and Asia (IFSDDAA) and Afro-Asian Studies Promotion Association (AASF) are jointly organizing this international conference in collaboration with the HAWK University of Applied Sciences and Arts, Goettingen, Germany and the Society for Sustainable Agriculture and Resource Management (SSARM), India. This year's conference also embarks on organizing innovation ignition and ideas' competition for young scientists for development of useful products and processes that can contribute positively to the welfare of human society.

Policy planners, researchers, scholars and NGOs in science & technology, agriculture, bio-technology, health care, economics, environment, skill development and entrepreneurship, social research streams are welcome to participate. The organizers will be happy to welcome the participants to the conference venue at AASF center at Mahatma Gandhi House, in Goettingen, Germany.

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# 2022: Global Trends to Improve Food Security and Human Health (2025/2052)

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## Abstract

Improving crops and crop production are key challenges today and in future to safeguard healthy life of all people living on earth. Everyone involved within these processes have to consider essential global trends in order to focus their work and to provide suitable solutions at the right time. The paper will address the following: Food Security, Basic Food, Plant-based Protein, Therapeutic Food, Fake Food, Pseudo-Science Food, Herbal Food, Probiotics, Personalized Food, Bio-Pharmaca, mRNA Technology, Personalized Medicine, Molecular Farming, Edible Plant-Based Vaccines. The future of farming, the future of food production/manufacturing, and the future of health care is revolutionized at an unprecedented speed driven by science and technology, COVID-19 pandemic, and Putin's war.

Science, agriculture, food production/manufacturing and health care must go hand in hand in a synergistic way. Crossbreeds from these essential sectors using cutting-edge genome editing technologies will enable to address successfully the following individual and global all over all targets by 2052: *i.e.* elimination of hunger and malnutrition, avoidance of social unrests, conflicts, migration, and war improvement of health and life, protection of the environment.

Actually, and in future, it is especially important to strengthen and sustainably develop the sense and morale to defend democracies that want to live in peace and freedom in the future. Improving food security and human health is a prerequisite of global peace. "The seed sprout", or in other words: "Planting the right ideas, so that they can also be harvested in future" (Kern, 2015). Last, but not least: "Science and technology will win, to enable a better life and a better future!". Let's grow together for a Better Life! – 2022 and beyond ...!

**Key words:** Food Security, therapeutic food, mRNA technology, COVID-19 pandemic, hunger and malnutrition

# Policies in Land Use to Achieve Carbon Neutrality By 2050: Why IPCC Summaries for Policy Maker and the Paris Agreement on Climate Change should now be completed

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## Abstract

Since 2015 the state of the world has not improved: the 2020-2022 pandemic, the false promises of the climate conference in Glasgow in November 2022, and the Russian-Ukrainian war which started in February 2022, have, inter-alia, completely changed policy priorities of developed countries, despite IPCC summaries and alerts for policy maker. In the new and likely more fragmented and changing world, what should and can be done in each country? Some high latitude countries are likely to benefit from better climate conditions for cereal production. But most countries are likely to face more adverse conditions and will need to adapt both their agronomical and forestry practices. They are also to rely more on their own capacities to increase, or at least to stabilize, domestic crop productions in warmer, more dry and more erratic conditions. In coastal zones they are sometimes also to cope with more saline conditions. Whereas at the same time national crop productions need to be increased in many countries, not only in developing countries with high population growth rates, but also in other countries to decrease their dependency on imported fuel, especially in the present times of uncertainty in global markets. This needs not only more research, but also different policies in agriculture, land use, biomass and in the energy sector.

But to adopt better policies, country decision makers as well as their compatriots are to better understand what are the alternative options and their consequences. In this regard SPMs (summaries for policy maker) of the 2009 Special report on Land Use and of recent SPM of group II (adaptation) & III (economics) are insufficient to guide properly national decision maker, and to generate more adequate national policies and measures. This is illustrated with different examples. Increasing biomass production can be achieved either by increasing cropland area (e.g. by deforestation) as in Latin America, Africa or South East Asia, or by increasing crop yields and land use efficiency (e.g. total annual biomass production per unit of land). But the first option will generate more GHG emissions at the global level. In this regard the 2023-2028 European Common Agricultural Policy proposals recommending increasing land area allocated for organic food production from 10% to 20%, will have similar consequences at the global level. In rich countries reducing crop inputs is generally considered as climate friendly. Although this is wrong, most policy maker ignores it, or wants to ignore it to be "green". IPCC SPMs have for instance even never mentioned the 2006-Abuja conference recommendations, which asked to increase average fertilizer input per hectare in Sub-Saharan Africa from 15 kg to 50 kg by 2015, a level still three times lower than in industrialized countries ! Crop yield gaps are never mentioned. Policy maker and average citizens from the North and the South generally do ignore that increasing crop inputs reduces the need for land use change and therefore GHG

emissions. They do ignore also that improving crop inputs in Sub-Saharan Africa could help, as shown by IFPRI studies, to better cope with future climate change.

In addition to that, metrics to compare GHG emissions per capita in different countries are yet to be updated and to be completed. Today they do take into account properly, neither GHG emissions of international trade, nor short term effects of methane emissions. Avoided GHG emissions due to biomass production should also be considered and highlighted in UNFCCC National GHG Inventories. Avoided GHG emissions resulting from efforts to limit land use change are today completely ignored. Policies of developed countries, to both mitigate climate change and to help other countries to adopt more sustainable development pathways have up to now failed. This in particular because IPCC summaries for policy makers can only be policy oriented and cannot be more policy prescriptive. The latter should therefore to be completed with reports, written by voluntary scientists, and unlike today, not be co-written with governmental representative. For all these reasons the 2015 Paris Agreement on climate should also be completed, if we are really to reduce GHG emissions globally. Today under the latter, equity issues are completely absent, and there also no binding commitments, which could for instance be based upon average GDP per capita in different categories of countries.

**Key words:** IPCC, SPM, GHG emissions, policy, GDP

## Resource Management

# Influence of elevated atmospheric CO<sub>2</sub> concentrations on global vegetation development and on yields as well as on product quality of agricultural plants

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## Abstract

The relationships between increased CO<sub>2</sub> supply on the one hand and vegetation development, plant growth, yield and quality of different crop species on the other hand were examined on the basis of observations and experiments (meta studies) available worldwide. Special attention was paid to FACE experiments (Free-air CO<sub>2</sub> enrichment method), but satellite surveys and chamber fumigation systems were also included. The results are: (1) The increase of the atmospheric CO<sub>2</sub> concentration by about 100 ppm during the last 100 years led to increased plant growth worldwide. The global vegetation cover increased by 11–14%, which is attributed by 70% to the increased atmospheric CO<sub>2</sub> content. Since 1982 the global tree population has increased by 7.1%. (2) The increase of the CO<sub>2</sub> content in the air (typically from 350 to 550 ppm) resulted in the yield increases of selected crops from 10 to more than 30%. (3) In Germany, from 1990 to 2015 the yields of wheat, barley, maize and potatoes increased by more than 30% which was partly due to the increased CO<sub>2</sub> content in the air. Across all crop species, the annual net CO<sub>2</sub> fixation in Germany is 96.3 million tons. (4) The CO<sub>2</sub>-related yield increases are based on an increase in photosynthesis performance. They were subject to large fluctuations depending on plant species, water supply and nutrient supply (especially N and P). (5) In the case of poor nutrient availability in the soil and insufficient fertilization, the CO<sub>2</sub> induced yield increase can be associated with a reduction in plant nutrient and protein concentrations (mainly due to "dilution effects") and thus with a reduction in quality. N (to a lesser extent also P) obviously plays a key role in this process. This can be compensated by adapted fertilization management and by breeding of drought-tolerant "low input" varieties with high nutrient utilization efficiency. (6) The CO<sub>2</sub> induced yield increases should be used to secure the world's food supply and improve the income situation in poorer countries.

**Key words:** Atmospheric CO<sub>2</sub>, global vegetation, yields, product quality, agricultural plants

# For an Integrated Strategy in Agronomy of Symbiotic Nitrogen Fixation and Engineering of Legume Ecosystem Services

## Pour une stratégie intégrée d'agronomie de la fixation symbiotique d'azote et d'ingénierie des services écosystémiques des légumineuses

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### Abstract

Fewer chemical inputs, as fertilizers or pesticides, become of paramount importance for the safety and impact on the environment of agricultural production of food. This implies new requirements with regard to the selection of legumes for grain-cropping systems and their inoculation with beneficial symbiotic and rhizospheric microbes. Low phosphorus availability limits crop yield in about 40% of the world's arable land, most particularly for leguminous crops when their growth depends upon symbiotic N<sub>2</sub> fixation (SNF). Therefore, our work aims to increase the phosphorus use efficiency (PUE) for SNF, and its contribution to a more effective coupling between the P and N bio-geochemical cycles in agriculture and forestry. For this purpose, the FTM interdisciplinary research strategy has been developed in agro-ecosystems of the Mediterranean basin and tropical Africa, with the support in particular, of the Great Federative Project FABATROPIMED of Agropolis Foundation under the reference ID 1001-009. The overall objective is to increase the benefit of grain-legumes for cereal systems and the environment by promoting the interaction between soil microbes for plants to acquire and use N and P most efficiently. The field activities include a participatory approach with farmers in reference agro-ecosystems offering a wide range of agroclimatical and socio-ecological situations. The nodular diagnosis revealed large spatial and temporal variation of SNF for cowpea common-bean and faba bean, often due to low soil P- availability. Functional genomics and ecology could be linked through the study of *Myo*-inositol hexakisphosphate (phytate) as the main source of organic P in soils. Only phytases are able to hydrolyse phytate efficiently into inorganic Pi, the only P form known so far as bio-available for plants. Phytase genes, both histidine acid and *beta*-propeller, were found in some rhizobia. Their expression within nodule infected-cells was shown by *in situ* RT-PCR. Plant phytase-genes were also found in nodules, and shown to vary significantly under P-deficiency among recombinant inbred lines of *Phaseolus vulgaris* that are contrasting in their PUE for SNF. It is concluded that yields of legume, and their stabilization, could be improved through an integrated strategy on their PUE for SNF and ecosystemic services.

**Key words:** bio-geochemical cycles of N and P, ecological intensification, legume crops, phosphorus use efficiency, phytate, symbiotic N<sub>2</sub> fixation.

# Addressing Food Security and Social Human Rights Through Sustainability Standards: Lesson's Learned from Asia, Africa and Latin-America

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## Abstract

With increasing global agricultural trade, awareness about negative environmental and social impacts of global supply chains is growing. Voluntary sustainability standards emerged as a response. Food security and social human rights have not yet received much attention despite the efforts to develop sustainable supply chains. Research about the impacts of sustainability standards also neglected food security. This research therefore aims first, to understand the relationship between sustainable certified export agriculture, food security and social human rights. Second, it analyses whether rights-based food security criteria for sustainability standards can be effective. The research is based on case studies from Bolivia, Guatemala, Kenya, Malaysia and Zambia targeting sugarcane, oil palm, coffee and cotton grown by smallholders, medium-sized and large plantations. A mixed-methods approach with a focus on qualitative research was applied. Seven multi-stakeholder workshops and over 100 interviews with workers, farmers, communities, standards, NGOs, enterprises and scientists were conducted. Respecting the Right to Food and other social human rights remains a challenge for certified farms, though larger farms are quite advanced compared to smallholders. Plantations have mixed effects regarding food security on workers and communities, depending on management and socio-economic context. Smallholders often earn low incomes and may experience themselves food insecurity. Rights-based food security criteria prove to be feasible for farms and sustainability standards. The criteria are able to reliably capture the food security situation of workers, farmers and communities and identify gaps. While plantations are expected to be able to comply with the criteria, not all smallholder farmers are able to meet all criteria. Rights-based food security criteria can be effective and positively impact workers, farmers and communities. Producers and exporters indicated interest in the criteria but require a market demand and higher prices. Without internalizing the external costs of production, including those to fulfill the Right to Food, no transformative change will be achieved. Though the criteria enable international buyers to prove their due diligence regarding food security, stronger regulatory frameworks are needed to stipulate all value chain actors to take on their responsibility.

**Key words:** Food security, social human rights, NGOs, multi-stakeholder

# Climate-Smart Agriculture: An Option for Increasing Crop Productivity and Mitigation of Greenhouse Gas in a Rice-Wheat System-A Case Study from India

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## Abstract

In Indo-Gangetic Plains (IGP) of South Asia, tillage, water, energy and crop residue burning in conventional management systems of RW rotation contributed significantly in greenhouse gas (GHG) emission/environmental pollution. Climate smart agricultural practices (CSAPs) are being deployed for adapting to climatic risks while enhancing productivity and quality of environment in the prevailing RW rotation of IGP. To evaluate GHG mitigation potential of various CSAPs, an on farm research trial was conducted during 2014-2017 in Karnal, India. Six management scenarios included; Farmer's practice/business as usual (FP); Partial improved FP(PI-FP); Improved FP(I-FP); Climate smart agriculture practices with low intensity portfolios(CSAP-L); CSAP with medium intensity portfolios(CSAP-M); CSAP with high intensity portfolios(CSAP-H). The global warming potential (GWP) of RW rotation was highest under FP and least under CSAP-H. Overall, estimated GWP of RW system under CSAPs was 37% lower than that under FP. Also, on an average, 6% higher RW system yield was revealed with CSAPs compared to FP (11.96 Mg/ha). Lower GWP under CSAPs resulted into 60% lower emission intensity (383 kg CO<sub>2</sub> eq./Mg/year) compared to FP (642 kg CO<sub>2</sub> eq./Mg/ year). Our results indicate that the validated CSAPs have potential to reduce environmental footprints of the RW rotation with similar or higher productivity.

**Key word:** Climate smart agriculture, RW rotation, greenhouse gas, GWP, productivity

# Regression Modeling for *Acacia seyal*/Volume Estimation from Tree Height, Diameter at Breast Height and Stump Diameter

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## Abstract

*Acacia seyal* is the most dominant tree species in Sudan with significant economic, social and environmental values. Development of methodologies to estimate the species wood volume, biomass and carbon contents is important for sustainable management in the context of reducing emission from deforestation and forest degradation. This study investigated the relationships of *A. seyal* trees volume with trees; other tree parameters and to estimate tree form factor. The field data was collected from Wad-Elbasir and Okalma forests in Elgadrif and Sinnar States, respectively. Compartments in Wad-Elbasher Forest contains of trees with deferent age-groups and stocking density. In the two forests, Systematic sample plots were determined and tree height (Ht), stump diameter (STD), diameter at breast height (DBH) were measured. Furthermore, twenty representative sample plots representing groups of *A. seyal* tree ages (range of 5–29 years) in Wad-Elbasher Forest were determined. A representative tree per plot was felled, sectioned into logs and measured, and then form factor and tree volume were calculated. The statistical analysis of the data included Analysis of variance and regression to test differences interrelationships based on adjusted coefficient of determination ( $R^2$ ) and  $P$  values. The relationships included tree volume, STD, DBH and tree height. The findings revealed tree age has significant effect ( $P = 0.027$ ) on tree form factor. In the two sites, the relationships of STD, DBH and Ht with tree volume was significant ( $P < .0001$ ) and strong. The  $R^2$  for STD, DBH, and Ht with tree volume is 0.99, 0.88, 0.62 respectively in Wad Elbasher; and 0.97, 0.98, and 0.58 in Okalma.

**Keywords:** *Acacia seyal*, tree volume, form factor, diameter at breast Height (DBH), Stump diameter

# Potential of Agro-forestry in Sustaining Wood Based Industries and Securing Farmer's Livelihood in India

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## Abstract

In India, area under agro-forestry (AF) is estimated to be in 8.2% of the total geographical area of the country which can further be increased up to a considerable level. AF in India is practiced in 13.5 million ha which is a means to reduce rural unemployment, with timber production on farms generating 450 employment days per ha per year. India was the first country to promulgate the National Agro-forestry Policy in 2014. In India, natural forest contributes just 6.4% of timber demand (3.17 million m<sup>3</sup>). India is meeting its wood demand through import of timber and allied products which are roughly 18.01 million m<sup>3</sup>. Thus, there is significant gap between demand and supply of wood in the country and import is bound to increase in coming years if concrete action is not taken to address the issue. As per a report, 50% of timber demand, 65% fuel wood demand, 70-80% demand for plywood, 60% of raw material for paper pulp and 9-11% of fodder demand is met from AF. Agro-forestry is a viable option for meeting the raw material demand of wood-based industries and to sustain them in long run. The key lesson from AF is that tree cover needs to be understood and managed as part of landscape, harmonizing agriculture and forestry policies. Because agriculture and forestry are treated separately in policies, there are challenges in how trees on farms should be managed. For a national level planning of agro-forestry to succeed, it is necessary to develop effective means of coordination between different sectors and the development of a common understanding of policy and legal issues affecting the adoption of an agro-forestry policy framework. This article presents a brief introduction of Agro-forestry, its potential and limitations, wood scenario in India, issues related to contract farming and the way forward.

**Key words:** Agro-forestry, plywood, timber, landscape, forestry policies,

# Technological Interventions to Improve Crop Water Productivity in Arid Agro-ecosystem: An Experience of North Western Rajasthan, India

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## Abstract

Field experiments were conducted at Agricultural Research Station, Sri Ganganagar, Rajasthan to find out optimum irrigation schedules for different crops through surface and pressurized methods of irrigation to improve crop water productivity. Optimum irrigation schedules were recommended for different crops. Experiments were also conducted to find out optimum crop geometry under drip system, optimum drip irrigation schedule and optimum fertigation schedule for American cotton (hybrid hirsutum cotton), Bt cotton, sugarcane and brinjal. The pooled results of the trials revealed that paired planting in Bt cotton, sugarcane and brinjal was found cost effective without any yield loss. In American cotton paired planting gave significantly higher seed cotton yield over single row planting. Drip irrigation schedule at 1.0 ETc, 1.0 ETc, 80 % PE and 1.0 ETc was found optimum for American cotton, Bt cotton, sugarcane and brinjal, respectively. The increase in yield of respective crops was 24.2, 31.0, 26.4 & 30.9 per cent and saving of water was 13.3, 32.9, 17.1 & 29.6 per cent over conventional practice. Drip irrigation also improved the quality of produce by increasing fibre length and fineness in cotton lint and commercial cane sugar to the extent of 35.8 per cent over conventional practice. The fertigation schedule 150 kg N and 20 kg K<sub>2</sub>O/ha (40 kg P<sub>2</sub>O<sub>5</sub>/ha as basal) in 6 equal splits at an interval of 15 days for American cotton, 120 kg N, 32 kg P<sub>2</sub>O<sub>5</sub> and 16 kg K<sub>2</sub>O/ha in 6 equal splits at an interval of 15 days and 2 per cent foliar spray of KNO<sub>3</sub> at 90 and 105 days after sowing for Bt cotton, 112.5 kg N and 30 K<sub>2</sub>O/ha (40 kg P<sub>2</sub>O<sub>5</sub>/ha as basal) in 9 equal splits at an interval of 20 days for sugarcane and 96 kg N and 48 K<sub>2</sub>O/ha (80 kg P<sub>2</sub>O<sub>5</sub>/ha as basal) in 12 equal splits at an interval of 10 days for brinjal was found optimum. The increase in yield of respective crops due to optimum fertigation schedule was 49.8, 15.6, 20.7 and 30.6 per cent and water saving was 13.3, 24.3, 25.0 and 29.6 per cent and fertilizer saving was 0, 20, 25 and 20 per cent over conventional practice of irrigation and fertilizer application. In both drip irrigation and fertigation water expense efficiency increased by 43.3 to 85.9 per cent over that of conventional practice. Thus, drip irrigation with fertigation was found a better option to increase water productivity in arid agro-ecosystem of Irrigated North Western Rajasthan.

**Key words:** Fertigation, crop geometry, American cotton, drip irrigation, Bt cotton

# Investigation of Groundwater Resources Management During Climate Change in Iran

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## Abstract

There is a deep connection between climate change and the groundwater resources situation. Climate change affects the aquifer system through rainfall, which is the main source of recharge for the aquifer. However, it should be noted, that groundwater resources might be under the influence of complex socio-ecological systems because of water consumption behavior and the social factors, along with the climatic situation. In this study, the role of groundwater management plans and laws in the periods of climate change in Iran has been investigated. Also, the alignment of laws and plans for the protection of groundwater resources from 1960 till now has been evaluated and the model of climate change adaptation policies has been obtained. According to this model, two different policies and plans for climate change adaptation are distinguished, which are: 1) water-based approach (limiting agriculture and protection of water resources) and 2) production-oriented approach (maintaining the amount of agricultural production regardless of the limitation of water resources. One issue in dealing with climate change and droughts, regardless of the water resources management policy, is to what extent these concepts have entered in policy-making and legislative systems. The results of this study indicate that the policy of groundwater resources protection in periods of climate change has undergone many changes in Iran. From 1960 -to 1980 the water-based approach (restricting groundwater abstraction and agricultural activity, importing agricultural products) had dominated groundwater management policies. While since the 1980s, despite successive periods of climate change, and groundwater plans in the form of a water-based approach, management policies, and laws have been in the form of production-oriented, and therefore groundwater resource overexploitation and reduction have occurred. This reduction in groundwater resources has led to serious restrictions in more than 404 of 609 study areas, and a cumulative storage deficit of around 135 billion cubic meters in groundwater resources. One of the water-based approaches in this period is the implementation of two Groundwater Resources Sustainability Management Plans by the Ministry of Energy to reduce groundwater abstraction in 2005 and 2014. Despite the efforts of the Ministry of Energy over the past fifteen years, the groundwater level is still declining. In fact, Due to the lack of coordination between policy-making institutions (legislature and executive), these plans have not led to groundwater resources sustainability. It means Sustainability and conserving groundwater resources (as a water-based approach) may be on the agenda of a water governance system, while the country's water law may not be in the interest of groundwater resources sustainability. In other words, plans and instructions are based on water-based policy, but water laws are on production policy. Hence, the contradiction between plans and acts will lead to the failure of scientific plans and cause many social consequences. This study showed that groundwater conservation plans would fail regardless of water-based law.

**Key words:** Climate change, groundwater sustainability, water-based approach, production-oriented approach

# Perspectives and Challenges of Rain Water Harvesting Ponds Technology in Nyagatare district of Rwanda

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## Abstract

Water is scarce commodity more so in sub sahran Africa on account of low rain fall and lack of irrigation facilities. Climate change as further aggravated water shortages in this area, for these reasons it would be imperative to harness rain water through Rain Water Harvesting Technology (RWHT). This study finds that households with rainwater harvesting ponds have significantly more benefits and higher income than their correlative of comparable observable characteristics. The study deduces that adoption of rainwater harvesting technologies has positive outcomes to farm households. The implication of these findings is that adoption of rainwater harvesting ponds presents a pathway for improving rural livelihood and living standard. Research and development (R&D) interventions should promote rain water harvesting technologies and need to put emphasis on quality rather than focusing on the number of adopters. Households are adopting the use of cleaner water obtained from household ponds and other sources of clean water. Also R & D interventions need to consider the labor and education level demand of the technology. The effectiveness of the technology adoption is mainly hindered by problems related to water supplies and technologies that one is using to minimize risks.

**Key words:** Climate change, rainwater harvesting, ponds, agriculture, livelihood

# Response of Hairamin for Enhancing Plant Growth and Yield in Different Crops

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## **Abstract**

Hairamin is a hydrolyzate of waste human hair developed by putting waste human hair in HCl and centrifuging it. It contains 6-8 % organic nitrogen and 18-20% organic carbon. It is diluted around 100 times before spraying it on cereal crops. It's directly diffusible from the leaf surfaces into the plants. An experiment on 12 genotypes of Bread wheat, 7 genotypes of Triticale and 4 genotypes of Durum Wheat was conducted at research farm of Department of Agriculture MMDU, Mullana, Ambala. The field experiment was laid out in Randomized Block Design (RBD) with three replications. Foliar spray of Hairamin was done at three stages of plant growth including tillering stage, stem elongation phase and pre flowering stage. 4ml of Hairamin was dissolved in one litre of water and sprayed with the help of hand sprayer. Observations on plant height was recorded in Hairamin treated plants and their control. Percent increase in plant height would give response of Hairamin over control. Accordingly all genotypes differ in their response to Hairamin ranging from low, medium and high response. In general response of Hairamin for plant height was best in durum wheat (17% above control) varying from 6-13% among four genotypes followed by triticale with average response (13% above control) ranging from 0-24% among seven genotypes and the lowest response was recorded in bread wheat with average response (9% above control) ranging from between 0-29% among twelve genotypes. Percent increase in yield was best in durum wheat 246 percent among four genotypes followed by triticale with 213.8 % among seven genotypes and the lower response was recorded in bread wheat with 189.7 % among twelve genotypes. Thus both genetic variability among genotypes within a group (bread wheat, triticale and durum wheat) as well as genomic diversity between different cereals was apparent.

Other experiment on American cotton (var. RS2013) revealed that Hairamin treatment resulted in increase in plant height by 20.46%, enhancement in the chlorophyll content of plant leaves by 16.32%, increase in weight of balls per plant by 19.21% as well as 14.32% reduction in immature ball formation per plant as compared to control and the total yield showed as increase of 13.63%. The study concluded that the foliar application of protein hydrolyzate along with recommended package of practices in Bt. hybrid cotton have promising results on the yield and growth of cotton under the field conditions.

Another experiment on plantation crop like banana revealed that biofertilizers based on pseudo-stem of Banana and Hairamin resulted in increase in chlorophyll content (50%), total biomass (35%), root and shoot (50%) and fruit yield (15%) as compare to control. Based on efficacy study it is concluded that plant growth promoter has shown encouraging fruit growth and can be promoted among banana cultivators to enhance the productivity of crop.

**Key words:** Hairamin, hydrolyzate, HCl, triticale, total biomass

# Performance of Different Wheat Varieties under Restricted Irrigation in North West Plain Zone of India

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## Abstract

A field experiment was conducted at Research Farm, Surender Kaur Memorial Agriculture College, Padampur, Sri Ganganagar to find out suitable variety of wheat under limited water availability. In Irrigated North Western Plain Zone of Rajasthan irrigation water is the main constraint in crop production. Ground water is brackish and rainfall is scanty. The crop production is mainly dependent on canal water supply. Under such situation crop varieties having tolerance to water scarcity has vital importance. With this objective the present investigation has been undertaken and six recently released popular varieties of wheat (WH 1105, HD 3226, HD 3086, Raj 3077, WH 1142, DBW 187) were tested separately under two moisture regimes (two and four irrigation levels) in randomized block design for three years (2018-19, 2019-20 & 2020-21). In the trial two irrigations were applied at CRI stage and flag leaf stage. In another trial four irrigations were applied at CRI, jointing, flag leaf and milking stages. The pooled results of the trial revealed that variety Raj 3077 gave the highest mean yield in both the irrigation levels but it was at par with WH 1142 (56.77 q/ha) at two irrigation level and HD 3086 (63.81 q/ha) and WH 1142 (62.62 q/ha) at four irrigation level. Thus, variety Raj 3077 and WH 1142 are suitable under limited water availability in irrigated North Western Plain Zone of Rajasthan, India.

**Key word:** Wheat, irrigation water, randomized block design, CRI stage, North Western Plain Zone of Rajasthan

# Effect of Different Level of N P K and Biochar on Soil Physico-Chemical Properties, Yield and Attribute of Finger Millet (*Eleusine Coracana*) var. – KM 65

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## Abstract

An experiment was conducted on “Effect of Different Level of N P K and Biochar On Soil Physico-Chemical Properties, Yield and Attribute of Finger Millet (*Eleusine Coracana*) var. – KM 65” during *Kharif* season. The design applied was 3x3 randomized block design with three level of NPK @ 0, 50, and 100 % ha<sup>-1</sup> three level of Biochar @ 0, 50 and 100% respectively. The result obtained with treatment T9-[NPK@ 100% + Biochar @ 100%] that showed Biochar in combination resulted in a slight decrease in pH 6.78 and EC increase 0.26 dS m<sup>-1</sup>. In post soil of NPK fertilizers observations were resulted in significant increase in OC 0.82 %, Particle density 2.63 Mg m<sup>-3</sup>, Bulk density 1.08 Mg m<sup>-3</sup>, Pore space 58.93% and available N 328.75 kg ha<sup>-1</sup>, P 36.10 kg ha<sup>-1</sup>, K 186.10 kg ha<sup>-1</sup>, significant increase in case of Nitrogen (kg ha<sup>-1</sup>), Phosphorus (kg ha<sup>-1</sup>), Potassium (kg ha<sup>-1</sup>) was found to be significant among other treatments in finger millet cultivation and soil quality improvement. The highest yield regarding, gave the best results with respect to plant height 110.18 cm, number of finger ear head<sup>-1</sup> 7.42, 1000 grain weight 3.48, it gave highest yield 27.29 q ha<sup>-1</sup> It was also revealed that the application of NPK with Biochar were excellent source for fertilization than fertilizers.

**Keywords:** Finger millet, soil, urea, SSP, Biochar

# Response of Different Varieties Green Gram (*Vigna Radiata* L.) to Different Sources of Manures and Fertilizers

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## Abstract

Mung bean has high nutrients and antioxidants which provide health benefits. In fact they protect against heat stroke, aid digestive health and lower blood sugar levels. Green gram (*Vigna radiata* L.) belongs to the family Leguminosae, which fixes atmospheric nitrogen and improves soil fertility by adding 20-25 Kg N/ha. The green gram foliage leftover after picking of mature pods can either fed to livestock or maybe ploughed in-situ as green manure to enrich soil organic matter. The seed coat and broken parts of the embryo or cotyledons are used as high-quality cattle feed. The objective of present study is to evaluate response of different mung bean varieties to inorganic fertilizers and combination of fertilizers and manure. Four varieties of mung bean namely MH – 421, SML – 668, PDM – 139, MDLS were sown in different six fertility gradients created by fertilizer and manure treatments These are ; T1-Control( no fertilizer), T2- 100% recommended N, P, K dose through chemical fertilizers, T3-75% recommended N, P, K dose through chemical fertilizers + 25% recommended N, P, K dose through FYM, T4- 50% recommended N, P, K dose through chemical fertilizers + 50% recommended N, P, K dose through FYM, T5- 75% recommended N, P, K dose through chemical fertilizers of NPK + 25% recommended N, P, K dose through vermin-compost, T6-50% recommended N, P, K dose through chemical fertilizers + 50% recommended N, P, K dose through vermin-compost. Observation were recorded on : days taken to emergence, days taken to 50% flowering, pod initiation, physiological maturity, root shoot ratio on length and weight basis, days to flowering and days to maturity, dry weight at 15,30,45 and at harvesting, Plant height at 15,30,45 and at harvesting, no. of branches per plant, no. of pod per branch, no. of seeds per pod, 1000 seed weight, seed yield/ha, straw yield /ha, grain yield per plant, biological yield, harvest index N,P,K content in grain and straw , N,P,K uptake in seed and straw. Our results revealed that MH 421 is the best performing variety for seed yield as well as response to applied nutrients under integrated nutrient management system

**Key words:** *Vigna radiata* L, Leguminosae, antioxidants, nitrogen, vermin-compost

# Efficacy of Endophytic (*Metarhizium Brunneum*) Strain 6c1 in the Control of Old-World Bollworm (*Helicoverpa Armigera*) in Okra

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## Abstract

*Metarhizium brunneum* strain 6c1 was evaluated for its capability to colonize okra *Abelmoschus esculentus* (L.) with toothpick inoculation method. The results reflected the ability of Mb-6c1 to colonize the whole plant tissue. Different parameters such as pupae success, area consumed, weight gain and faeces dry weight bioassay were conducted to test whether the colonization of Mb-6c1 could affect the performance of bollworm *Helicoverpa armigera* by means of toothpick. The results showed that the inoculation had a significant pupae success, in particular, a gradual reduction of number of pupations were 80%, 73%, 20%, 13% for the control, Tween800.01% (v: v), ( $1 \times 10^7$  conidia/ml) and ( $1 \times 10^5$  conidia/ml), respectively. Consumed leaf area was significantly influenced by the treatment ( $p < 0.05$ ) with a mean of  $63.13 \pm 11.90 \text{ cm}^2$  and  $54.65 \pm 10.32 \text{ cm}^2$  for the high concentration and low concentration treatments, respectively. Nevertheless, Mb-6c1 increased the root dry weight of okra plants and acts as plant growth regulation. Mb-6c1 was crucial for the dietary uptake and growth of *H. armigera*, and consequently could be a mycoinsecticide target for the development of pest management and environmentally friendly.

**Keywords:** *Metarhizium brunneum*, *Helicoverpa armigera*, *Abelmoschus esculentus*,  
Conidia colonization, mycoinsecticide

# Response of Bio-fertilizers and Growth Regulator on Growth and Seed Yield of Fenugreek

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## Abstract

A field experiment was carried out to study the effect of two different levels bio-fertilizers and their combinations with three different levels of foliar application of plant growth regulator (GA3) on plant growth parameters and seed yield of Fenugreek (*Trigonella foenumgraecum* L.) cv.- RMT-1. The objective was to find out the optimum level of GA3 application in combination of bio-fertilizers on yield parameters. In all there were 13 treatments combinations as follows: T1: control, T2 : seed inoculation with rhizobium, T3: seed inoculation with rhizobium+25ppm GA3 (Foliar spray), T4: seed inoculation with rhizobium+50 ppm GA3 (foliar spray), T5: seed inoculation with rhizobium+100ppm GA3 (foliar spray), T6: seed inoculation with PSB, T7: Seed Inoculation with PSB + 25 ppm GA3 (Foliar spray), T8: Seed Inoculation with PSB + 50 ppm GA3 (Foliar spray), T9 : Seed Inoculation with PSB + 100 ppm GA3 (foliar spray), T10: seed inoculation with rhizobium + PSB, T11: seed inoculation with Rhizobium + PSB + 25ppm GA3 (foliar spray), T12: seed inoculation with Rhizobium + PSB + 50ppm GA3 (foliar spray), T13: seed inoculation with rhizobium +PSB+100 ppm GA3 (foliar spray). Based on results of the field experiments in terms growth parameter like plant height ,number of primary and secondary branches per plant at 30, 60 and 90 DAS, length of internodes, days to 50% flowering, fresh and dry weight of the plant and seed yield parameters like days to first pod formation, days to 50 % pod formation, number of pods per plant, weight of pod, pod length, number of seeds per pod, weight of seeds per pod, seed yield per plant, seed yield/ha, and harvest index, the treatment (T13) seed inoculation with rhizobium+PSB+100 ppm GA3, had resulted in maximum of shoot and grain yield. This was followed by followed by treatments T12: seed inoculation with rhizobium+PSB+50ppm GA3 (foliar spray) and a minimum gross return was found in Control. The percentage increase in shoot and grain yield was significant over control.

**Key words:** *Trigonella foenumgraecum*, Bio-fertilizers, PGR, GA3, seed and yield.

# Scope and Importance of Horticulture in Haryana

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## Abstract

Haryana State lies in North-West plane zone of India marked by High temperature in summers and low temperature in winters. There are two distinct eco-geographical zones in Haryana *i.e.* Northern Agro Ecological Zone and Southern Agro Ecological Zone. In Northern Agro Ecological Zone, there is high precipitation ranging from 550 mm to 750 mm annually. This zone is represented by Panchkula, Yamuna Nagar, Ambala, Karnal and Kurukshetra. The cropping pattern in this zone is dominated by Rice-Wheat rotation. Sugarcane and potato are important crops. The central Haryana is having average rainfall ranging between 350 mm to 500 mm annually. This zone is represented by Kaithal, Jind, Fatehabad, Hisar, Sirsa, Rohtak and Jhajjar. Cotton-Wheat rotation, Rice-Wheat rotation, Bajra-Mustard rotation are pre-dominant in this area. In Southern Agro Ecological Zone the weather is relatively dry. Rainfall is below 350 mm annually and where irrigation facilities are available there Bajra-Mustard, Bajra-Pea, Mungbean-Urdbean and occasionally cotton, groundnut and carrot are important cropping patterns. However, in Haryana 55% of underground water is of poor quality which is main source of water. Consequently, most soils in Haryana are having pH ranging from 7.5 to 8.5 in such situation all annual crops witness some kind of environmental stresses. The soils are getting depleted because of modern crop varieties exploiting nutrients from limited soil profile. Crop diversification is therefore warranted. In Northern Zones fruit crops like mango, green apple, peach, pear and plump can be successfully grown with higher economic dividend to growers. In Central Haryana, fruits like guava, kinnow, strawberry can be successfully grown. Likewise in Southern Haryana ber and malberry can be grown with success. These options would effectively increase land use efficiency and net returns to the farmers. Establishment of fruit processing industry will further boost the farm economy and make fruits and fruit derivatives available for most part of the year. Horticulture will therefore be economically and environmentally sustainable.

**Key words:** High temperature, high precipitation, Agro Ecological Zone, pH, sustainable

## New Developments in Plant Breeding with Genome Editions

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### Abstract

Plant breeding is one of the most important starting points for the human and animal food/feed chains. Cultural plants are not real natural products; they base on more than 10 000 years of selection beginning in inter river country in Asia Minor. The people selected plants under consideration of their yields. Plant breeding as a scientific discipline started about 100 years ago at our Research Stations. At the end of the last Century plant Breeders introduced Genetic Modification as method of plant breeding. Later (about 2015) Genome Editing (Genetic scissor) followed as next technique. Plant breeders are able to influence location and type of Genome. CRISPR (*Clustered Regularly Interspaced Short Palindromic Repeats*) and Cas9 (*CRISPR associated protein*) and further techniques (*e.g. Mega nucleases, TALEN, Mutagenesis etc.*) have the potential as New Molecular biological Techniques (NMT) to improve plants, such as: -More resistant against diseases

- Better adaptation to weather and climate
- Influences of yield and plant composition
- Lower application of chemicals
- Higher yields and improved composition
- Positive effects on sustainability of food and feed systems.

In the mean time, more than 500 new treatments with genome edited plants (*e.g. China: 282; USA: 126; EU: 82; Japan 30; UK: 21; India: 13*) were tested. A further increase of applications may be expected in the next time.

Further details can be found by Flachowsky and Jany (2022): Flachowsky, G., Jany, K.-D. (2022) Contributions of Gene Technology for global Food Security (in German). Behr's Verlag, Hamburg, Germany, 190 p.

**Key words:** Plant breeding, CRISPR, genome editing

## Vision Paper-5

# Pulse Crops: A key to Sustainable Agriculture, Food and Nutritional Security

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## Abstract

Food and nutritional security are key to improved human health and wellbeing. In the twentieth century significant advances in agriculture helped us to achieve food security around the globe. Agricultural production system intensification and homogenization combined with population growth, economic development and climate change has changed food production systems around the world. Homogenization of food systems has assured easy availability of food around the world, but it has also increased the incidence of chronic diseases severely impacting human health and wellbeing. There is a growing trend towards diversified plant food based diets to achieve nutritional security, reduce the incidence of chronic diseases and also help the environment. Pulses are a good source of dietary proteins that are more environmentally friendly to produce than animal proteins. Partial substitution of cereal flour with pulse flour can be used to produce healthy products. Mixed cropping of cereals and pulses reduces the need for inputs and improve soil health. Diet diversification provides more choice to the consumers, can overcome the challenges of chronic diseases, while helping to protect the environment.

**Key word:** Nutritional security, economic development, climate change, dietary proteins, chronic diseases

## Developing Low Glycaemic Index (GI) Pearl Millet for Combating Type-2 Diabetes in India and Africa

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### Abstract

Type-2 diabetes (T2D) is a massive global issue facing the mankind. There were 422 million diabetes sufferers worldwide in 2014, up from 108 million in 1980. Prevalence is rising more rapidly in low- and middle-income countries than in high-income countries. The number of (type 2) mainly non-insulin dependent diabetics in India is currently estimated at 77 million (up from 50 million in 2010) and in sub Saharan region 15 million (expected to rise to 40 million by 2045). Globally, 1.5 million people die every year due to type-2 diabetes. Diabetes can be treated, and its consequences avoided or delayed with diet, physical activity, medications and regular screening and treatment for complications. However large population in India and Africa cannot afford medications or specialized food for treating diabetes. It is estimated that for a low-income Indian family with a diabetic adult, as much as 25% of family income may be devoted to diabetes care (source: WHO). The cereal crop pearl millet (*Pennisetum glaucum*) is one of the most abundant crops grown in India and sub Saharan Africa, and provides a staple food for many poor communities. Compared to other cereal crops such as wheat and maize, pearl millet is high in nutritive content (e.g. proteins, B-complex vitamins, zinc, magnesium, and iron), is gluten free, and has a low GI, making it an interesting candidate to selectively breed for lower GI for use in diabetes control diets. In this presentation, I will cover the extent of genetic variation present in global collection of pearl millet germplasm for starch traits (slowly digestible starch (SDS) and resistant starch (RS)) that contribute to low GI in this crop. The global collection of pearl millet germplasm (known as pearl millet inbred germplasm association panel, PMiGAP, 346 entries) was assembled and utilized for uncovering global genetic variations for SDS and RS. The PMiGAP was subsequently re-sequenced leading to 28 million SNP variants for each of the entry of the 346 entries of the PMiGAP. Genome wide association studies (GWAS) identified SNPs associated with genetic variation observed for starch and other health benefitting traits (such as micronutrients, antioxidants, lipids). Based on phenotypic and genotypic data, entries were selected that possessed high SDS and RS (low GI) as well as high micronutrients content (Fe and Zn) and yield. Approaches being used in utilizing such entries, and the linked SNPs to starches and other health benefitting traits, in developing affordable pearl millet grains for the benefits of type-2 diabetics worldwide will be discussed.

**Key words:** Type-2 diabetes, *Pennisetum glaucum*, PMiGAP, micronutrients, antioxidants

## Breeding Activities at Nordic Seed, Denmark

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**Abstract**The most important goal of the breeding program is to provide farmer nationally and internationally high yielding varieties that have improved diseases resistance and they can cope with climate changes. For this purpose developed varieties through conventional pedigree breeding or with the help of DH-development. Recently, we are employing speed breeding to accelerate our breeding cycles. In the early generation, we employ markers assisted selection for in particular for disease resistance. These DNA markers should be very closely linked to particular diseases. We are employing routinely genomic selection in early breeding program in early generations in crop we bred at Nordic Seed. To calculate genomic prediction, thousands of lines are being genotyped with 20.000 and 50.000 SNPs marker (single nucleotide polymorphic markers), respectively. The GS (genomic selection) model has been developed in cooperation with Aarhus University. For example, to identify new sources of leaf rust resistance we phenotyped a large number inbreeding lines for rust resistance. By employing a genome-wide association study using ca. 260.000 SNP markers we were able to identify five resistance associated QTLs on chromosome arms 1RS, 1RL, 2RL, 5RL and 7RS.

**Key words:** Pedigree breeding, DNA markers, nordic seed, rust resistance, QTLs

# Crop Improvement

## Environmental Effect on Yield and Quality Parameters in Bread Wheat (*Triticum aestivum* L.) Cultivars at Various Growth Phase under Rainfed Conditions

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### Abstract

The fluctuation and higher temperature is mainly abiotic environmental factors may influence bread wheat yield and quality during grain filling phase in Trakya region, Turkey. It was investigated effect of the temperature, between Z24 and Z89 growth phase, on yield, quality and some agronomic characters in bread wheat cultivars. The mean and maximum temperatures from tillering (Z24) up to grain filling period (Z89) were taken in experimental area. This research was established with 25 genotypes in a randomised complete block design (RCBD) with 4 replications in Edirne and Tekirdağ location, from 2010-2011 (E1) to 2015-2016 (E6) growing cycles. In the study, 5 local varieties were selected and investigated on grain yield (GY), 1000-kernel weight (TKW), test weight (TW), protein ratio (PRT), wet gluten content (GLT), gluten index (IND), grain hardness (HARD), sedimentation value (SED), plant height (PH) and days of heading (DH). According to the results of research, there were various relations between environment, cultivar and temperature. In Edirne location, across six environments, the mean grain yield was in the range of 4454-8158 kg ha<sup>-1</sup>, E4 was the highest yielding environment and E6 was the lowest. As a result of the environmental effect, there was a 45.4% difference between the highest and lowest yield. The highest TKW (47.2 g) was in E4 and the lowest (34.3 g) in E1. Test weight varied across six environments the lowest was in E3 and the highest in E2. Environment E1 had higher protein ratio and wet gluten content, E4 had the lowest protein ratio and wet gluten content. Gluten index varied from the lowest in E6 (71.3%), and the highest was 93.3 in E4. There was highly variation in sedimentation value across six environments. The lowest value was in E4 (40.0 ml) and the highest was in 64.8 ml in E1. In the Tekirdağ location, the mean grain yield was in the range of 5485-8283 kg ha<sup>-1</sup>, so there was a 33.8% difference between the highest and lowest yield. The highest (46.6 g) and lowest (39.5 g) TKW was in environment E2 and E1. Test weight varied across six environments the lowest was 81.1 kg in E4 and the highest 85.2 kg in E2. Environment E3 had lowest protein ratio, E1 had lowest wet gluten content, E2 had the highest protein ratio and wet gluten content. Across six environments, gluten index varied from the lowest in E2 (74.8%), and the highest was 94.5 in E1. The lowest sedimentation was in E4 (42.2 ml) and the highest was in 47.0 ml in E5.

**Keywords:** Bread wheat, environment, temperature, yield, quality characters

# A Comparative Evaluation of Morphological and Molecular Diversity in Indian Mustard (*Brassica Juncea* L.) for High Temperature Stress Tolerance

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## Abstract

**Background:** This study was conducted to evaluate genetic diversity and relatedness among eight brassica genotypes of Rapeseed-Mustard using morphological yield contributing traits. The genetic diversity is then confirmed by microsatellites or simple sequence repeats (SSRs) markers which provide an efficient tool in diversity studies for identifying the degree of genetic similarity.

**Methods:** In this study eight (four heat susceptible and four heat tolerance) parent were sown in randomized block design with three replications at research area of CCSHAU, Hisar during 2015-16. In each replication five plants were selected randomly for data analysis.

**Result:** The D<sup>2</sup> analysis revealed that number of number of primary branches per plant, secondary branches per plant, siliqua angle, 1000 seed weight and speed of germination contributed more than 70% of the total divergence. According to D<sup>2</sup> analysis genotypes were grouped into three main clusters. Based on molecular data dendrogram were generated based on an average linkage algorithm (UPGMA) using marker data and the eight genotype of mustard were grouped into two main clusters which were further divided into three sub-clusters separately A, B and C at similarity coefficient of 0.75. The variation among at parents was observed significantly. In the diversity analysis 50 primers were tested among which 5 primers were polymorphism and there were total of 48 alleles were amplified. Average polymorphic information content (PIC) value was observed highest for the SSR primer *BN\_3F164* (0.76) followed by *SSR Ni2-A07* (0.65) and lowest for the primer *SSR Na12-D03* (0.50).

**Key words:** *Brassica juncea*, genetic diversity, morphological traits, Parent selection, SSR markers.

# Selection of Wheat (*Triticum Aestivum*) Varieties for Yellow Rust Resistance Through Molecular Analysis of *Yr* Genes

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## Abstract

Molecular analysis of *Yr* genes in wheat (*Triticum aestivum* L. Em.Thell) was conducted to evaluate 210 recombinant inbred lines of bread wheat to identify *Yr* genes using SSR markers, estimate variability and associations among the various traits. Medium to high values of GCV, PCV, heritability and genetic advance as percent of mean for grain yield per plant and biological yield in both years indicating a high scope of selection for these traits followed by 100-grain weight, number of spikelets per ear, harvest index, days to heading and days to maturity. Grain yield was significantly and positively correlated with biological yield, harvest index, number of tillers per plant, ear length, number of spikelets per ear, plant height and number of grains per ear, whereas negative and significant correlated with days to heading in both years. Biological yield and harvest index had high direct and indirect effects on grain yield per plant over the years, indicating the true relationships with grain yield, in this set of recombinant inbred line population. Fifteen, out of 70 SSR markers used were found polymorphic in parental genotypes and in RILs. The gene *Yr7*, *Yr18*, *Yr26*, *Yr29*, *Yr36*, *Yr47* and *Yr53* were linked to yellow rust resistance in the present investigation. The RIL No. 52 with 4 *Yr* genes (*Yr7*, *Yr36*, *Yr47* and *Yr53*) had better performance for the traits loaded on PC-2, namely grain yield per plant, biological yield and number of tillers per plant and showed 4 *Yr* genes (*Yr7*, *Yr36*, *Yr47* and *Yr53*). This line was also better than overall mean for grain yield and its components. The lines *viz*, RIL No. 13, 24, 31, 120, 121, and 134 showed a desirable combination of the traits loaded on PC-1 and PC-2, namely grain yield per plant, biological yield and number of tillers per plant and complemented with disease resistance. Among these lines, RIL No. 24, 121 had 2 *Yr* genes (*Yr18*, *Yr26*, *Yr7* and *Yr47*). The RIL No. 117, 25, 12, 15 had better performance for the traits loaded on PC-1, namely grain yield, biological yield and ear length and showed 2 *Yr* genes out of *Yr7*, *Yr47*, *Yr18*, *Yr36*, *Yr26*, *Yr29*, *Yr26* and *Yr29* observed in the present study. The RIL Nos. 12, 15, 25 were also showed better performance than mean values in terms of grain yield and its components.

**Key words:** *Triticum aestivum* L. Em.Thell, SSR markers, GCV, PCV, heritability

# Studies on General and Specific Combining Ability Effects in Onion Using Male Sterile, Maintainer and Restorer Lines and Hybrids

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## Abstract

Onion (*Allium cepa* L.) is the most diversified crop of the family Alliaceae; it is in cultivation since ancient era for its edible bulbs and verdant foliage due to the immense nutritional and medicinal properties. An experiment was conducted at Research Farm of Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *rabi* season over two years to identify male sterile lines using morphological and cytological markers for their maintenance and hybrid production of onion. The male sterile line were developed in the genetic background of variety of Onion namely Hisar 2. Eight cytoplasmic male sterile line (MS 20, MS 21, MS 22, MS 23, MS 34, MS 35, MS 37 and MS 40) and two maintainer line (Pollinator 5 and Pollinator 11) were identified on the basis of flower morphology and test cross with fertile pollen donor plant (Maintainer line) using acitocarmin staining as cytological marker. Identified male sterile lines were crossed with three restorer to develop hybrids. A field trial was conducted to evaluate the performance of male sterile lines, maintainer lines and hybrids. Observations were recorded, bulb yield attributes like plant height, bulbs size, diameter of bulb, average weight of bulb, total bulb yield, marketable bulb yield, moisture content of bulb, dry matter content of bulb, total soluble solids of bulb. The analysis of variance exhibited significant genotypic difference, showing considerable amount of genetic variability among the genotypes. PCV were observed to be higher than GCV for all the characters studied. Among all eight lines, the line MS 20 was found good general combiner for more number of traits studied. Line MS 34 was found good general combiner for number of leaves per plant, average weight of bulb, total bulb yield, marketable yield, moisture content of bulb (%) and dry matter content of bulb (%). Among the tester Pusa Red showed good general combining ability for plant height, diameter of bulb (polar & equatorial), average weight of bulb, total bulb yield, marketable yield, moisture content of bulb (%), dry matter content of bulb (%) and total soluble solids of bulb (%). Tester Pusa Red was observed as good combiner for plant height, number of 'B' grade bulb and polar diameter of bulb. The preponderance of both additive and non-additive gene actions for yield, its components and quality parameters suggests for both selection and heterosis breeding for the improvement of onion crop. Based on GCA of the parent, SCA of the hybrids and mean performance of hybrids following crosses namely MS 35 x Hisar- 3, MS 37 x Hisar-3, MS 22 x Agrifound Dark Red, MS 40 x Pusa Red and MS 21 x Pusa Red could be exploited for the development of onion hybrids and also for selecting desirable segregants to develop pure line varieties.

**Key words:** *Allium cepa* L., Alliaceae, cytoplasmic male sterile, PCV and GCV

# Screening of Aloe (*Aloe barbadensis* Miller) Promising Elite Genotypes for Leaf Yield and Gel Content

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## Abstract

A field experiment was conducted during the years 2018-19, 2019-20 and 2020-21 to evaluate the performance of six elite Aloe (*Aloe barbadensis* Mill.) genotypes for cultivation under semi-arid conditions of Haryana at Research Farm of MAP Section, Department of Genetics and Plant Breeding CCS Haryana Agricultural University, Hisar. The results on the basis of mean performance over three years on leaf yield data of all six genotypes revealed that, the highest fresh leaf yield (414.50q/ha) was recorded by IC112526 followed by HAV-05-8 (408.81q/ha), HAV-04-4 (396.33q/ha), IC112516 (388.94q/ha), HAV-07-9 (374.78q/ha) and HAV-1(356.78q/ha). Data on alternaria leaf spot diseases parameters indicated HAV-05-8, HAV-1, IC112526 and HAV-07-9 as the resistance genotypes, IC112516 moderate resistance and HAV-04-4 as susceptible genotype. Likewise, on the basis of soft rot disease parameters HAV-1 and HAV-05-8 exhibited the resistance, IC112526 and IC112516 were moderately resistance, and HAV-04-4 and HAV-07-9 were susceptible. Under different environment conditions, the elite genotype, HAV-05-8 were found able to perform better and was significantly superior in fresh leaf yield, gel content (%) and was found resistance to major diseases therefore, this genotype may be recommended for cultivation in semi-arid region of Haryana after further testing their preference over time and space.

**Key words:** Aloe (*Aloe barbadensis* Mill.), elite genotypes, resistance, leaf yield and gel content (%)

# Investigation of Promising Forage Sorghum Genotypes for Fodder Yield and Quality

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## Abstract

Forage sorghum is an important fodder crop in Indo-Gangatic plain of India. It is main source of fodder for livestock production during *summer* and *Kharif* season in Haryana. Owing to its high dry fodder yield potential sorghum is used for hay and silage making in addition to a potential source of green fodder. There is 11.24 and 23.4 per cent deficit of green and dry fodder, respectively in our country. Therefore, keeping the above facts in view we have evaluated 21 forage sorghum genotypes during *Kharif* 2021 for fodder yield, quality and insect pest incidence. Maximum green fodder yield was reported in SPV 2809 (654.6 q/ha) followed by CSH40F (622.8 q/ha), CSH36F (622.3 q/ha) and SPH1984 (617.3 q/ha) and the same genotypes also recorded highest value of dry fodder yield *i.e.*, SPV2809 (160.59 q/ha) followed by CSH40F (152.33 q/ha), CSH36F (150.29 q/ha), and SPH 1984 (150.67 q/ha). Maximum crude protein per cent was recorded in SPV2799 (11.02%) followed by SPV2805 (11.02%) and SPH 1985 (10.72%) and *in-vitro* dry matter digestibility was maximum in CSH36F (57.8%) followed by SPV2797. Maximum TSS% was reported in SPV2809 *i.e.*, 7.89. In addition to the above genotypes CSV21F, a forage sorghum variety released at national level is also performing better for all the promising morphological and quality traits. The genotypes SPV2809, CSV21F, CSH36F and SPH1985 are tolerant to major insect pests of forage sorghum like shoot fly and stem borer. Based on high green and dry fodder yield and better quality the genotypes SPV 2809, CSH36F and CSV21F should be exploited for silage making and could be used by dairy farmers for establishing a small scale silage unit at village level.

**Key words:** Forage sorghum, green fodder, dry fodder, quality, silage

# Assessment for Genetic Diversity in Mungbean [*Vigna Radiata* (L.) Wilczek] Genotypes for Yield Attributing Traits and Yellow Mosaic Disease (YMD)

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## Abstract

Mungbean [*Vigna radiata* (L.) Wilczek.; 2n=22] is third most important pulse crop of India after chickpea and pigeonpea. However, its productivity is quite low. The main reason for low productivity of mungbean is lack of genetic variability, stability, poor harvest index and susceptibility to various biotic and abiotic stresses. Therefore, assessment of genetic variability and diversity is imperative for improvement in mungbean productivity. Among its important biotic stresses, Yellow Mosaic Disease (YMD) is the foremost production constraint in Asia which may lead up to 100% yield losses under severe incidence. Breeding for resistance is the best suitable method to overcome this disease. The present study meant to assess the genotypes for high stable yield and YMD resistance. One hundred ten accessions of mungbean were screened during rainy season of 2021 for these traits at Hisar (29°10'N, 75°46'E) which is a hot spot for this disease. The per cent disease incidence (PDI) of YMD was monitored up to eight week after sowing which varied between 0 to 51%. The germplasm were grouped into highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible depending upon severity of infection. The differential reaction of mungbean genotypes to YMD was observed, three genotypes were found highly resistant and twelve were found resistant. Fifty seven genotypes were moderately resistant and forty four were moderately susceptible. Remaining six accessions were classified as susceptible. The results revealed that most of the genotypes were classified under resistant to highly susceptible. UPGMA method of Hierarchical Cluster analysis grouped these genotypes into seven distinct clusters comprising of 3 to 36 genotypes. Maximum inter cluster distance was observed between cluster VII and VI (25.13) followed by cluster VII and I (21.53). YMD incidence was observed less in cluster II and VII and they had also more no. of clusters/plant, no. of pod/plant, no. of seed/pod, high seed yield/plant, high biological yield, harvest index. These accessions can be used in future breeding programmes to develop high yielding YMD resistant cultivars.

**Key words:** MYMV, mungbean, resistant, PDI, field screening.

# Evaluation of Wheat Genotypes for Organic Farming

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## Abstract

Wheat is an important cereal crop. Wheat grain yield has increased many folds due to the introduction of semi-dwarf wheat varieties which are responsive to inorganic fertilizers. Due to excess use of fertilizers, soil as well as human health is also deteriorated. So, keeping in view this thought present study was planned to evaluate wheat genotypes which perform better under organic conditions. In this study, a total of 24 wheat genotypes were evaluated in timely sown conditions in a plot size of 6.0 X 1.20 m in RBD design with three replications at CCS Haryana Agricultural University, Hisar (India). The data were recorded on days to heading, days to maturity, plant height, tillers number per meter length, lodging %, 1000 grains weight and grain yield. The grain yield range was 37.9 q/ ha (WH 1105) to 60.4 q/ ha (WH 1292). The other wheat genotypes which perform better under organic conditions are namely, WH 1297, WH 1299, HD 3086, WH 1403, WH 1080 and HD 2967. Hence these genotypes can be further used in organic farming system.

**Key words:** Wheat, grain yield, RBD, organic farming

# Colored Wheat a Need of Future

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## Abstract

The consumers' demands have changed from energy providing diet to a diet with a balanced nutrient profile along with metabolic, physiological and functional health benefits. They are seeking colorants derived from natural sources to enhance the nutritional and antioxidant value of foods. Colored (black, purple, blue and red) wheat grains have gained much attention recently due to their attractive nutritional values. A major type of pigments responsible for the colouring in colored wheat are anthocyanins, primarily located on the aleurone layer or pericarp. Morphologically, colored wheat is similar to amber wheat in all aspects except its grain colour and nutritional composition. As compare to conventional amber wheat, colored wheat grains are high in macro-nutrients such as carbohydrates, lipids and proteins, as well as in micronutrients such as vitamins, minerals, phytochemicals, TDF and other bioactive substances. The gluten content in colored wheat is low as compare to the conventional wheat. The gluten index for colored wheat is 69.78, which is in range of optimum gluten index required for bread making (60-90). Low gluten content provides an option of specialized food products for celiac disease patients. The amino acid of colored wheat is more heat stable than conventional wheat, which favour positively in dough extensibility, strength and baking performance. The major constraints in production of colored wheat is their low yield potential as compared to amber wheat. The average production of the common wheat is 55 to 65 q/ha but in case of colored wheat it is 45 to 55 q/ha. There is also lack of awareness among the people about colored wheat cultivation even in some areas farmers don't even hear about colored wheat. As colored wheat has ability to combat and address global and national challenge of malnutrition. So, there is need for development and utilization of several products from colored wheat with better nutritional and functional properties with added health benefits.

**Key words:** Anthocyanin, colored wheat, malnutrition, phytochemicals

# Comparison of Some Triticale Genotypes in East Anatolia/Turkey in Terms of Yield and Some Quality

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## Abstract

In the study carried out in the Eastern Anatolia Region of Turkey, Triticale Regional Yield Trial consisting of 25 genotypes was established in Erzurum-Aziziye, Erzurum-Pasinler, Erzincan and Muş locations in rainfed conditions in 2020-2021 season and the genotypes were compared in terms of yield and some quality characteristics. Differences between locations, genotypes and location x genotype interaction were found to be statistically significant ( $p<0.01$ ). When the locations were examined one by one, very important ( $p<0.01$ ) differences were determined between the genotypes at allocations. The year 2020-2021 has been a year with the lowest yields of many years. A great drought was experienced in our region as well as in our country, and it had the highest impact in Pasinler location where the trials were established. Therefore, the lowest yield was obtained from Pasinler location (1698 kg/ha). This was followed by Erzincan (2239 kg/ha), Muş (2801 kg/ha) and Aziziye (3069 kg/ha) respectively. In the general average, the yields varied between 1990-3035 kg/ha, the average of the selected genotypes (2476 kg/ha) was above the average of the standards (2340 kg/ha) and the trial average (2452 kg/ha). Genotypes selected from trial were examined in terms of protein content, 1000 grain weight and hectoliter weight. When the protein ratios of the genotypes were examined, it was found that all of them had a protein ratio of more than 12%, 72% had a protein ratio of 12-15% and 28% had a protein ratio of more than 15%; When 1000 grain weights are examined, 71% of the genotypes are under 35 g, 26% are 35-40 g; 3% of them have a weight of 1000 grains between 40-45 g; When evaluated in terms of hectoliter weights, 35% of the genotypes were below 75 kg; 75-80 kg of 64%; It was determined that 1% of them had a value between 80-85 kg/hl.

**Key words:** Eastern Anatolia Region, rainfed conditions, triticale, protein content, yields

# Studies on Graft Compatibility of Red Globe on Different Dogridge Rootstocks

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## Abstract

Dogridge is the commercially exploited grape rootstock in the country and in southern interior Karnataka. Red Globe is gaining popularity and its area increasing among grape growers. In many vineyards, it has been documented that grafting Red Globe onto Dogridge doesn't gave better graft success, and needs repeated grafting to make uniform plant population. This investigation was conducted at Division of Fruit Crops, ICAR-IIHR, Bengaluru to study the graft compatibility of cv. Red Globe grafted onto five rootstocks; Dog ridge, Freedom, 110R, SO4 and 66/4 in pot experiment. The results showed that better graft success percentage (57.14, 67.14 and 67.58%, respectively) was recorded on 110R rootstock at 60, 90 and 120 DAG, the maximum shoot length, leaf number per shoot, stock scion ratio, total leaf area per shoot, shoot dry matter percentage, specific leaf weight, leaf water potential, total chlorophyll content, peroxidase, polyphenol oxidase activity revealed better stionic combination with of 110R with Red Globe. The graft compatibility at union level was also confirmed with histological images where the callusing was good with 110R compared to other rootstocks. To improve the graft success percentage an *in-situ* grafting study was conducted in Red Globe onto Dogridge with different pre-treatments of scion. The results of this experiment revealed that maximum graft success percentage (70.37, 68.97, 75.86 and 68.00%) at 30, 60, 90 and 120 DAG, respectively was recorded in combination of pre-conditioning + BAP @ 100 ppm application, and similarly the maximum shoot length, leaf number per shoot, leaf area, shoot dry matter percentage, specific leaf weight, leaf water potential, total chlorophyll content, PPO and POD activities were higher with combination of pre-treatment of scions with pre-conditioning + BAP @ 100 ppm. The confirmation of this study revealed by the results of images of scanning electron microscope. The ultimate outcome of this experiment not only helps in finding the best stionic combinations in Red Globe, but also helps to find out the best scion treatment to reduce graft failure in Dogridge rootstock.

**Key words:** Graft compatibility, Red Globe, stionic, *in-situ* grafting, Dogridge.

# Capsicum Diversity Assessment through Shannon-Weaver Diversity Index and Characterization

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## Abstract

Biodiversity is the paramount concern globally and under this vegetable more specifically chilli has its noteworthy significance due to both agricultural importance as well as contribution in economic value. The continual transposition of the current global climatic condition, which cause emergence of novel abiotic and biotic stresses demanding for chilli having higher resilience ability. The diverse genome of the wild relative and farmer's collection observed as good assert for resolving these problems. Thus, the experiment was performed at Maharajpur Farm under the Department of Horticulture, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.) during the *Kharif* season 2019-2022 and planted in Randomized Complete Block Design (RCBD) with three replications. Shannon-Weaver diversity index assessment and the characterization of thirty capsicum lines collected from farmer's field and Indian Institute of Varanasi Research (IIVR) were evaluated for thirty-five qualitative traits articulated no variability for trait i.e., the monomorphic trait was non-enveloping fruit calyx cover, two descriptors were found to be moderately diverse, which were with medium fruit intensity of the red colour (at the mature unripe stage) and the narrow triangular shape of fruit with the Shannon-Weaver diversity index  $H'=0.46$  &  $H'=0.50$ , both of these traits are fruit related. The descriptor intensity of pubescence (hairiness) of the stem had the highest diversity index of 1.82. The studies highlighted some of the collections with the distinctness, MPKC-1 (Katni collection) addressed unique features with green with purple tinge leaf colour, purple petal colour, upright fruit orientation, absence of fruit curvature, purple fruit colour at ripening maturity, ovate leaf and erect plant habit, depicting it like a wild relative of capsicum, which could be utilized as the morphological descriptor in QTL mapping and as a genetic source for future resilience breeding programme.

**Key words:** Biodiversity, resilience, shannon-weaver diversity index, genetic resource, morphological descriptor

# Tissue Manipulation for Mass Production of Plantain Seedlings

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## Abstract

Banana (*Musa paradisiacal*) contributes to about 13.1% of the domestic agricultural product in Ghana accounting for production quantity of 3.6 billion kilograms in an area of 3.3 billion square meters. Locally, the crop ranks high in food preference with about 95% consumed locally. The crop, being rich in iron and other essential nutrients, is noted to produce many local dishes such as 'fufu', 'kelewele', 'red red', 'eto', 'mpotompoto', 'oguo', 'borededwo' and other important dishes that are of economic value. Not only used as food for humans, the peels and leaves are also rich sources of nutrients for domestic animals. The leaves, as well as the pseudo-stem, also perform other roles in the society such as the production of fabrics, cover for cocoa fermentation, medicinal formulations, and regalia for festivities. The production of this important crop is coupled with a major challenge such as planting materials acquisition. Since farmers mostly rely on suckers for planting, scientists have developed various innovations to multiply plantain suckers to make plantain materials more accessible to farmers and to ensure the commercial production of the crop. Although the use of the tissue culture technique has proven to be more effective, it is very expensive to set up a laboratory or prepare a media for the technique. The new technique recently developed is the tissue manipulation technique which offers huge potential to produce adequate planting materials. Tissue manipulation: is the process by which one plantain sucker is used to produce many plantain seedlings which later develop into suckers for planting. This technique was based on the idea that plantain consists of an underground stem known as the corm. The corm consists of a central bud or apical meristem, from which the leaves and the flowers are initiated. Thus, it is from the corm that the bunch is initiated. The corm of the plantain also has lateral buds which grow as suckers. Plantain suckers were cut at the base and their roots are carefully removed together with the skin with a cutlass to get rid of nematodes and their eggs in the roots and around the base to prevent disease at the nursery. Care must be taken when doing this in order not to destroy the corm of the sucker. The apical meristem was killed by deeping a knife in the middle of the ex plant several times to prevent the meristem from germination and allow the eyes to sprout as new seedlings when nursed. A nursery bed was prepared using bamboo, palm branches and blocks, the chambers are filled to one-third (1/3) full of sawdust. The ex-plants are now arranged firmly on the sawdust in the chamber and covered again with sawdust and watered. The whole chamber was finally covered with a transparent polythene bag with the help of nylon rope. The eyes of the suckers start germination after two weeks. Matured seedlings are removed by cutting the seedlings at the joint of the sucker in the sawdust with a knife. Seedlings are immediately planted firmly in smaller polythene bags filled with fertile soil and watered again for proper growth and development until they are fully matured for planting.

**Key words:** *Musa paradisiacal*, essential nutrients, pseudo-stem, biotechnology, ex-plant

# Root Bio-Engineering for Drought Tolerance in Sesame (*Sesamum Indicum* L.)

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## Abstract

Sesame (*Sesamum indicum* L.) by virtue of its adaption to varying soil and weather conditions including stresses is ideally suited to replace low-yield crops, especially in the current scenario of global warming affecting crop productivity. However, the low productivity (~43%) of sesame is a major challenge and is principally due to abiotic stresses. Like other crops, breeding efforts to improve crop yield are in general focused on aboveground, shoot-related phenotypes, whereas the roots as ‘hidden half’ of the plant are still an under-utilized source of crop improvement. Under the study, the currently known root system architecture (RSA) response in sesame to drought has been explored to unravel genetics of root traits, seed yield and its component traits. Fifty seven sesame (*Sesamum indicum* L.) accessions were evaluated during *kharif*, 2019 and 2020 in an alpha design. Plants were harvested at 35 DAS in the first trial, and at 35 and 50 DAS in the second trial for recording observation on root system architecture. Root length density (RLD), root and shoot dry weights, Root to total plant dry weight ratio (R/T), shoot dry weight to root length density ratio (S/RLD) were calculated as an indicator for different physiological parameters. The data from each trial were analyzed using a linear additive mixed effects model and the statistical procedure of residual maximum likelihood (ReML) was employed to obtain the unbiased estimates of the variance components and the best linear unbiased predictions (BLUPs) of the performance of the sesame accessions. At 35 DAS, there was a significant genotypic variability of RLD in both the years, with heritability ( $h^2$ ) of 0.51 in the first trial and 0.54 in the second trial. R/T had shown large genotypic variability as well as had relatively high heritability ( $h^2 = 0.55$ ) in the first trial, and a lower heritability ( $h^2 = 0.21$ ) in the second trial at 35 DAS. S/RLD also exhibited large variation with a good level of heritability at 35DAS ( $h^2$  of 0.37 in the first and 0.47 in the second trial). In general, the heritability values and the range of variation of RLD values across years were high compared to other root related traits. A known drought avoidant variety, TKG-306, was confirmed among those with the most prolific root systems in the mini-core germplasm, although various other lines from the collection showed more extensive roots. This information can very effectively be used as a valuable baseline for breeding programs and QTL mapping of drought avoidance in sesame.

**Key words:** *Sesamum indicum* L, abiotic stresses, RSA, RLD, QTL mapping

# Live stock Breeding and Production

## Resilience in Farm Animals – Importance for Sustainable Livestock Husbandry

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### Abstract

Cattle and pigs, especially cows and sows have a tendency to be resilient. Naturally, there is great individual variability. It is known that farm animals react very differently to individual influencing factors that have the same effect. This is where the term "resilience" comes in, which can be translated as "spring force" (cushioning). Resilience is a prerequisite for the conservation of species and the ability of individuals to survive in different environments. At the present time, when farm animal husbandry is subject to a broad social discussion with regard to extensification, animal welfare and resource protection, it is necessary to breed cattle and pigs with a high degree of resilience. This is because performance breeding generally goes hand in hand with an increasing sensitivity of the animals to harmful environmental factors and the variety of environmental factors that have an impact is increasing. These include, among other things, herd management, the climate, feeding, husbandry, but also pathogen loads of all kinds and diseases. High-performance cows and sows react to this to different degrees. In the case of the animals that react sensitively, this very often leads to a loss of performance, illnesses and to early selection from the herd. This has a negative effect on economic efficiency and above all represents an important animal welfare problem. It directly affects the ethical justification for us humans to breed and keep high-performance animals. This is particularly true for the very fertile cows in milk production and sows in piglet production. This problem cannot be viewed in a single-causal way, because the production diseases, causes of reduced performance and early selection are multi-factorial. The closely interrelated exogenous and endogenous factors play a role. The multitude of influencing variables, e.g. metabolism and fertility, interact via negative and positive feedback mechanisms. Thanks to the buffer capacity of the individual, there are often delayed reactions to the influencing factors. Thanks to promising scientific studies and results including gene editing, reliable answers can already be given to the question of how resilience is expressed in high-performance farm animals, is it measurable and predictable and is the result with a view to improved animal health with consequences for longevity in the breeding senses usable.

**Key words:** Cattle and pigs, resilience, cushioning, multi-factorial, breeding

# Parameters of Efficient Production of Edible Protein of Animal Origin

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## Abstract

The global population will increase to about 10 billion people up to 2050 and the amount of required and consumed food. The demand for food of animal origin will dramatically increase, but this development is scrutinized because of the high need of limited natural resources on the one side, such as arable land, water, fuel, some minerals (e.g. phosphorus), and some gaseous emissions on the other side, such as CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and in some cases also because of the food competition to humans. Growing global population and increase per-capita incomes and urbanization imply an increase in animal food demand and a certain pressure to expand agricultural land. At the moment, animal products provide about 18% of the global human food energy and 25% of the protein on a global basis. The global demand for meat and milk is expected to increase by 57 and 48% resp. between 2015 and 2050.

There are some main drivers for food/feed competition between man and animals:

- The feeding of human edible materials to animals (so-called hef-fraction)
- The use of arable land to produce animal feed (instead of food directly)
- Water, fuel etc. are also limited and should be considered in studies/analysis.

Apart from arable land, water and some minerals, there are also further limiting factors for food security and sustainable food production (see also Flachowsky *et al.* 2018).

There are various ways to analyse the efficacy of production of animal edible protein:

- Arable land need for edible protein yield
- Consideration of inedible food materials as feed

Most studies were achieved with standard diets and global yield averages. Individual yields/conditions were only seldom considered or investigated.

Based on our previous calculations (Flachowsky *et al.* 2017, Windisch and Flachowsky 2021), the objective of the present presentation is to compare various models under consideration of different plant and animal yields, human edible feed fractions (hef) and feeding conditions to compare arable land need for production of edible protein of animal origin. At the end of our calculations, some parameters should be compared and discussed.

**Key words:** Edible protein, animal origin, natural resources, animal feed

# Feed Additives in Ruminant Nutrition

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## Abstract

Water, energy, protein and some other substances, such as minerals or major elements (calcium (Ca), phosphorus (P), magnesium (Mg), sodium (Na), potassium (K), sulfur (S), chloride (Cl) etc.) are the most important essential ingredients of animal feed.

Furthermore, there is also a lot of minor substances – also called as feed additives – which are important for animal health and welfare and animal yields. The substances may be distinguished in essential additives, such as amino acids, trace elements and vitamins on the one side and many non-essential additives, such as antioxidants, enzymes, stabilizers etc. on the other side. All the substances mentioned above, are summarized as feed additives (see Table 1).

**Table1:** Essential and Non-essential feed additives (according to EFSA)

Essential (Nutritional) Additives	Non Essential Additives
- Amino acids (Lysine, Methionine, Threonine, Tryptophane <i>etc.</i> ) plus Urea	Acidity regulators
-Trace elements (Cobalt (Co), Copper (Cu), Iodine (I), Iron (Fe), Manganese (Mn), Selenium (Se), Zinc (Zn)	Anti-caking agents
Vitamins (Fat soluble; Vit. A, D, E, K) and (Water soluble vitamins (B <sub>1</sub> , B <sub>2</sub> , B <sub>6</sub> , B <sub>12</sub> ; Biotine, Folicacid, Niacine, Pantothenic acid)	Antioxidants
	Binders
	Colorants
	Gut Flora Stabilizers
	Emulsifiers
	Enzymes
	Gelling agents
	Hygiene condition enhancers
	Methane inhibitors
	Mycotoxin binders
	Preservatives
	Reduction of radio nuclides
	Silage additives
	Stabilizers of digestive tract
	Thickeners
	Further non-essential Feed Additives

The significance of those and further substances are discussed in detail by the European Food Safety Authority (EFSA 2018).

**Key words:** Feed, additives, ruminant, nutrition

# An Evaluation of Alternative Cooperative Breeding Program Designs for Smallholder Dairy Cattle Farmers

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## Abstract

In Sudan, there is a dearth of systematic breeding programs for optimizing milk yield performance of indigenous cattle breeds, and smallholder dairy cattle farmers often have limited access to improved genetic resources. In the present study, a stochastic simulation approach was performed to evaluate alternative breeding programs for small holders of the Sudanese Butana dairy cattle. The breeding programs included within-village breeding program and the exchange of breeding bulls between village groups. Three approaches of selection for young bulls were evaluated for each breeding program: Random mating, phenotypic selection, and selection based on estimated breeding values (EBV). Comparisons of both annual genetic gain in standard deviation units (SD) and genetic variance in the breeding goal trait (lactation milk yield) were made between the two breeding programs and selection methods. The results showed that under a within-village breeding scenario, the annual genetic gain was 0.43 with selection based on EBV of bulls, and 0.20 with phenotypic selection. Under the exchange of village bull breeding scenario, the genetic gain varied from 0.18(phenotypic selection)to 0.37 (selection based on EBV). The exchange of breeding bulls across villages, however, retained the highest genetic variance under all three methods of bull selection. Our findings also revealed an influence of herd size on genetic gain, with the highest genetic gain (3.4 -3.6 SD) occurring under EBV selection in the within-village breeding scenario when herd size per village varied from 276 to 460 cows. We propose the within-village breeding program with bull selection based on EBV as a viable option to achieve higher genetic gain. If higher genetic variance should be retained, the exchange of village bull breeding scenario is recommended.

**Key words:** A stochastic simulation, Sudanese Butana dairy, phenotypic, genetic, EBV selection

# Utilization of Goat's Milk Innutrition of Children Under Five Years Old in El Fashir

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## Abstract

This research aimed to study utilization of goat's milk for children nutrition under five years old in El Fashir state. Descriptive analytical method was used; structured questionnaire was designed, revised then used as a main tool for data collection. Fourteen (14) districts were selected randomly in the town then 75 questionnaires were distributed to 75 households. After answering the questions the data collected were presented in tables and expressed in percentages as results. The following results were obtained: the main breed raised in the town was the local breed (desert goats) with 72%, cross 25.3% and exotic 2.7% respectively. Daily milk yield was 0.9 kg and lactation length was 5 months. Utilization of milk was for self-sufficiency, purchasing, processing and others at 77.3, 12, 1.3 and 9.4%, respectively. The form of milk utilization was 25.3% for drinking 12% for eating and 62.7% for both. The people who answered that milk produced was sufficient were 65.3% were those who answered with no were 34.7%. The segments used milk in the family was, children under five years, youth and elderly with 66.7%, 6.6% and 26.7%, respectively. Most of the people belief that goat's milk cur malnutrition diseases with 80%. Most of the respondents (97.4%) agree with goat's milk as a substitute to mother's milk. The majority of questionnaires agree very much (98.7%) that goat's milk increase children cleverness, where only 1.3% disagree with it.

**Key words:** goats, milk, harsh, arid, cheap, cow's milk, infants, sensitivity

## Health and Environment

### Yeast Models for Detecting Redox Stress by Heavy Metal Toxicity and Pesticides

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#### Abstract

It is well known that heavy metals and pesticides could cause various diseases owing to their ability to increase redox stress. In most of the living cells, Peroxiredoxins (Prxs) are antioxidant proteins that are involved in cellular defence against the reactive oxygen species and reactive nitrogen species. Humans have six peroxiredoxinshPrxI-VI, out of which hPrxI and hPrxII belongs to the typical 2-Cys class sharing 90% conservation in their amino acid sequence including catalytic residues required to carry out the peroxidase and chaperone activities. Our lab recently developed a yeast model expressing human peroxiredoxins and found that it can be utilized to understand the mechanism of action of antioxidant rich functional foods as well as to gain mechanistic insights into the redox balance in the cells. Due to indiscriminate use of pesticides and increasing concentration of heavy metals in the irrigated and drinking water, our system can be utilized to understand the effects of these pollutants on the redox health of cells. It is found that deletion of SOD1, GPX1 or YAP1 increases the sensitivity of our strain. Moreover, the presence of heavy metals and pesticides further decreases the growth of cells which can be overcome by expressing human peroxiredoxins. The results strongly implicate that eukaryotic cell employ various proteins to decrease the burden of redox stress due to pesticides and heavy metals and, yeast could be utilized to screen ground water for checking the levels of pollutants.

**Key words:** Yeast models, redox stress, heavy metal toxicity, pesticides, peroxiredoxins

# Pinus Roxburghii Constituents Immuno-Enhancing Potential and Anti-Tumor Effects of Bio-Fabricated Silver Nanoparticles

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## Abstract

*Pinus roxburghii* has been used in the Himalayan region as folkloric remedy while nothing is yet known about its immunomodulatory and anticancer potential. The ethyl acetate fractions (EAF) of both fallen and green needles of *P. roxburghii* displayed highest mitogenic activity on human peripheral blood lymphocytes (PBL). These fractions significantly enhanced the release of IFN- $\gamma$ , IL-2 and TNF- $\alpha$  cytokines and CD3+, CD8+, and CD56+ immune cells. EAF also augmented the cytotoxicity of PBL towards various cancer cells (HCT-116, HeLa, PC-3 and A549). Moreover, *in vivo* studies also revealed the immunoboosting potential of the EAF of pine needles leading to tumor reduction and increased life span of Ehrlich ascites carcinoma (EAC) bearing mice. In another study, the silver nanoparticles were synthesized via *P. roxburghii* needles (PNb-AgNPs). The characterization of the nanoparticles showed spherical structure with an average diameter of approximately 80 nm. PNb-AgNPs exhibited significant cytotoxicity towards both A549 and prostatic small cell carcinomas (PC-3) with IC<sub>50</sub> values of  $11.28 \pm 1.28$   $\mu\text{g/ml}$  and  $56.27 \pm 1.17$   $\mu\text{g/ml}$ , respectively. PNb-AgNPs induced apoptosis by enhancing mitochondrial depolarisation, reactive oxygen species generation, caspase-3 and Poly (ADP-ribose) polymerase 1 activation resulting in DNA fragmentation. Also, a reduction in tumor growth and body weight following PNb-AgNPs treatment in EAC-bearing mice was observed. Collectively, *P. roxburghii* needles and its nano-formulation could act as cancer therapeutics.

**Key words:** *Pinus roxburghii*, immunomodulatory, nanoparticles, cytotoxicity, tumor

# Human Edible Fraction (heffraction) as Parameter for Human Nutrition

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## Abstract

In the near future more than eight billion people will live on the earth and in 2050, upto 10 billion people will live on the earth. Presently, about 2 000 m<sup>2</sup>arable land would be available per inhabitant to produce food for people. In 2 050 only about 1 500 m<sup>2</sup>would be available per Inhabitant to produce food for people. The only one conclusion would be: More food for more people with less resource input and lower emission scan bei considered as the largest challenge for all those, working along the whole food chain. We have to consider a strong competition for food/feed between man and animals.

**Table 1:** Human edible fractions (hef-values) of various feeds by some authors

Feed	CAST (1999); Wilkinson (2011)	„hef“-Values by Ertl et al. (2015)		
		Low	Medium	High
Barley	80	40	60	80
Maize	80	70	80	90
Wheat	80	60	80	100
Soybean	80	50	72	93
Rapeseed	20	30	59	87
Wheatbran	20	0	10	20
Maizesilage	0	19	29	45
Grass and otherforages	0	0	0	0
By-products of food Industry <sup>1)</sup>	0	0	0	0

<sup>1)</sup> By-products of food industry, such ascerealbrans, extractedoilseedbrans, sugarbeetpulp

That means, in the future we have to consider various fractions of plants and to use only a certain portion for animal nutrition in order to feed humans.

The values given in Table 1 are average values and they may depend on many influencing factors as demonstrated for three meal types from wheat (Table 2).

**Table 2:** hef-values (in %) for wheat under treatment (Calculation by the author)

Objective of the treatment	Very fine flour	Coarse flour	Whole meal flour
hef (in %)	60	80	100

These hef-values may help to assess the nutritive value of by-products for animal nutrition.

In addition to the hef-values, there is also the possibility to assess various feactions/ ingredients of the plants, for example the protein in human edible protein“ (hep fraction). In summary, by-products of food for animal nutrition may contain various fractions, rich in fibre and other substances.

**Key words:** Human Edible Fraction (heffraction), human nutrition

# A Survey-Based Study on Antimicrobial Resistance (AMR) and Its Substantial Impact on Health Systems

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## Abstract

According to the World Health Organization (WHO), currently existent health care facilities across the globe have proven inefficient to treat common infections including urinary tract infections and diarrheal diseases. This situation is indicated by the high levels of Antimicrobial Resistance (AMR) to drugs that are often used to treat infectious diseases. The prime goal of our project is to investigate the knowledge and perceptions among the citizens about AMR. A cross-sectional, web-based study was conducted among the public about AMR during the second week of January 2022. A 20-item survey instrument was developed and distributed randomly among Indian citizens. In particular, a general survey on knowledge, attitude, and practice regarding AMR was asked as a form of a questionnaire. The results were then statistically analyzed. We believe the paper will shed light on how insights from behavioral economics can enrich public health policies and interventions not only for AMR but also for the fight against COVID-19.

**Key words:** WHO, COVID-19, Antimicrobial Resistance (AMR), health policies

# Synthesis, Biological evaluation and Molecular docking studies of some newly synthesized Imidazole derivatives for anti-diabetic studies

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## Abstract

In modern drug technology, molecular docking is used for better understanding to drug-receptor interaction. In present study there are 20 Imidazole derivatives having Imidazole moiety were synthesized. All research molecules were underwent molecular docking studies for the inhibition of alpha glucosidase enzyme, PPAR gama agonist (They are characterized by their ability to decrease insulin resistance and have been suggested to slow down the progression of insulin resistance) and GLUT-4. The in-silico molecular docking studies shows that all newly synthesized compounds having minimum binding energy and have good affinity towards the active pocket, thus they may be considered as good inhibitor of alpha glucosidase.

**Keywords:** Imidazole, PPAR gama, GLUT-4, alpha glucosidase, in silico molecular docking, modern drug technology, anti-diabetic studies.

# Evaluation of Anti-Inflammatory Activity on Hrbc for Iron Nanoparticles Synthesised from Holy Basil – *Ocimum tenuiflorum* L.

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## Abstract

*Ocimum tenuiflorum*, commonly known as *holy basil or tulsi*, is an aromatic perennial plant in the family *Lamiaceae*. It is native to the Indian subcontinent and widespread as a cultivated plant and is integral part of every house hold of India for its medicinal and herbal properties. It is used to synthesize green nanoparticles with diverse inorganic metal and evaluated for their antimicrobial, anti-inflammatory and antioxidant activities. Green synthesis of silver, zinc, platinum and copper metals from leaf extract of *Ocimum* sp. has been reviewed in literature. The green nanoparticles (NPs) of silver were tested for their efficacy against *Staphylococcus aureus*, *S. pneumonia*, *P. aeruginosa*, *E. coli* and *Vibrio* sp. A greater conversion of platinum ions to nanoparticles of 23 nm size was achieved by employing a tulsi leaf broth with a reaction temperature of 100<sup>0</sup>C. The similar hydrogen evolution potential and catalytic activity like pure platinum was observed with reduced platinum which potentially can be used in water electrolysis applications. Banerjee et al., 2014 prepared nano-composite of silver NPs with the soil and applied for adsorption of dye, showed higher removal of reactive turquoise blue dye from effluent solutions. In the present study we explored the potential of iron nanoparticles synthesized using Response Surface Method (RSM) approach from Tulsi leaf extract and observed that activity of synthesized FeNPs increased with increase in molarity, this may be due to excess of Fe ions available at higher molarity leading to increased number of synthesized FeNPs. The size and stability of synthesized FeNPs have impact on anti inflammatory activities.

The maximum anti-inflammatory activity of Fe nanoparticles were observed, when they were synthesized using 0.1 M molar concentration of FeSO<sub>4</sub> solution having pH 8.0 at temperature of 25°C. The stabilization of human red blood cells (hRBC) membrane was observed as a measure of the anti-inflammatory activity. The synthesized iron nanoparticles showed the most significant percentage membrane stabilization of 36.71% and 44.048% with comparison to Diclofenac sodium which showed 13.85% and 12.47% at 200 and 100 µg/ml, respectively. Hence, it was observed that anti-inflammatory activity of extracts was dependent of diverse parameter viz., pH, temp and molarity.

**Key words:** Evaluation, anti-inflammatory activity, hRBC, Holy basil, *Ocimum tenuiflorum*

# Uranium In Drinking Water Sources In Rohtak, Jhajjar, Rewari, Bhiwani And Mahendragarh Districts of Haryana, India

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## Abstract

A survey of spatio-temporal variation and distribution of uranium in drinking water sources in Rohtak, Jhajjar, Rewari, Bhiwani, Mahendragarh districts of Haryana, India was conducted for mapping uranium content in drinking water sources across India under the national uranium project. The strategy for the survey of uranium content and other water quality parameters was based on the guidelines of geochemical mapping designed by the International Union of Geological Sciences (IUGS) Commission. Sampling area was divided into optimized grid size of 6 km x 6 km for systematic and unbiased sampling using latitude and longitude as reference coordinates for integration into the national map. Pre and post monsoon samples were taken from each grid. About 370 surface as well as groundwater samples, used for drinking purpose, were collected covering approximately 12000 sq. km. Pulsed Light emitting diode-based fluorimeter having wide dynamic range and 0.2 ppb lower detection limit was used for direct measurement of uranium content in the water samples. Uranium was detected in 85 % of all the collected water samples. Out of 12 water quality parameters measured to understand the geochemical processes governing uranium content in water sources, eight were found to exceed the acceptable limits set by the Bureau of Indian Standards for drinking water. The parameters sulphate, chloride, nitrate, fluoride, total dissolved solids, alkalinity and hardness exceeded their limits by 8.3, 15.8, 17, 22, 35, 46 and 52% respectively. Uranium content in 86% of groundwater samples was found to be less than the national limit set by the Atomic Energy Regulatory Board for radiological safety. Dissolved uranium content in groundwater samples showed an upward trend with total dissolved solids and depth of water sources. No surface water samples collected from community water works exceeded the prescribed regulatory limit.

**Key words:** Uranium, water quality, fluoride, nitrate

# Analysis of uranium concentration in the groundwater of Punjab

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## Abstract

The present work deals with the determination of uranium in groundwater of Sangrur district of Punjab. Fifty samples of groundwater are collected in pre-cleaned 1LTeflon bottles from different locations of the area using Global Positioning System during pre and post monsoon seasons for consecutive years (2015 and 2016). Along with uranium, samples were also analyzed for physico-chemical properties by American Public Health Association (1999) protocol. Laser Fluorimetry technique was used for uranium quantification which is based on the measurement of fluorescence of uranium complexes in aqueous solution. The results showed that uranium content in the studied samples varied from 5.81 µg/l to 31.53 µg/l and were within the permissible limits (30 µg/l) recommended by World Health Organization (2011) as well as Atomic Energy Regulatory Board (2004) i.e (60 µg/l) except sample no. 40 having uranium little higher than the recommended value of World Health Organization. Moreover, radiation dose due to intake of uranium through drinking water is found in the range of 8.73E - 02 to 4.74E - 01 mSv/y to adult population with an average value is 2.37E - 01 mSv/y respectively. Cancer risk is lower than the permissible limit ( $< 10^{-3}$ ) (United States Nuclear Regulatory Commission, 1995) as Total Hazard Quotient is less than 1 showed that there might be non-carcinogenic risk due to the drinking water.

**Key words:** Physico-chemical characteristics, uranium, groundwater, cancer risk

# Technology

Vision Paper-9

## Sustainability Impact Evaluation of Artificial Intelligence Research

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### Abstract

Planned obsolescence as proposed by B. London in 1932 became a corner stone of seemingly perpetually increasing economy with-out taking into account its impact on sustain-ability of ecology and resources. Starting from the Modelica World 3computational model being the basis of future development projections made by the Club of Rome, key indicators for sustainable development are population, resources, food, land, economy and ecology. By using these indicators, 3 artificial intelligence projects will be evaluated with regard to their contribution to sustainable development: emotion classification, malaria diagnosis and crop disease classification. The key indicators are found to provide a qualitative measure of the sustainability impact of IT research projects and beyond. As a draw-back the measure requires system domain knowl-edge and potentially complex modeling capability to cross the bridge from qualitative assessment to an objective metric. Never the less its potential lies in the capability to sensitize the engineering community towards sustainable research.

**Key words:** Artificial intelligence, limits-to-growth, sustainable engineering, UN 17 sustainable development goals

## Improved processing techniques for surplus fruits and vegetables in East Africa: theFruVaSe project

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### Abstract

In this inter-disciplinary project six universities from Kenya, Tanzania, Uganda and Germany work together on improved resource-efficient processing techniques and new market solutions for surplus fruits and vegetables for rural development in East Africa.

Deficiencies in vitamins and minerals in human nutrition, so called “hidden hunger”, are a major constraint in Sub-Saharan Africa. At the same time, Sub-Saharan Africa is home to about 3,000 species of fruits and vegetables (FVs) which could supply the required nutrients. However, plenty of FVs are lost along the value chain. Seasonality, minimal or no processing and long distances between production areas and consumption centers contribute to the problem.

Therefore, the overall objective of the FruVaSe project is to improve nutrition and economically empower women in East Africa through improved, sustainable processing of highly nutritious surplus fruits and vegetables and their by-products in a life-cycle approach. The focus is on cowpea leaves and guava in Kenya, African nightshade and cashew apple in Tanzania, and cassava leaves and jackfruit in Uganda. Consumer acceptance and possible buying barriers of new FV products will be taken into account while aiming for improved healthy diets and higher dietary diversity. Activities include

- Selection of the nutritionally most promising varieties of the target fruits and vegetables
- Development of new and evaluation of traditional technologies for processing and prolonged shelf-life
- Evaluation of consumer acceptance and commercialization of products
- Assessment of nutritional status of women and children and the contribution of processed FVs to sustainable diets
- Model development of an energy autonomous, resource-efficient processing procedure
- Establishment of a water re-use concept, and innovative purification of drinking water for juice production

FruVaSe commenced in September 2018 and will run until December 2022.

**Key words:** Improved processing techniques, surplus fruits and vegetables, East Africa

# A Study on Using Agricultural Waste for Evaporation Reduction in Arid Regions

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## Abstract

One of the major problems in water planning and management is controlling high evaporation rates from reservoirs, especially in arid countries located on Arabian Gulf such as Saudi Arabia and Iraq. Evaporation reduction can help in increasing water saving and thus reducing water stress. Many types of covers were internationally used to reduce evaporation from small reservoirs or open surfaces but these covers have negative environmental impact. It is required to find an effective cover with minor environmental consequences. A massive agricultural waste such as that from date palm trees is disposed annually. Palm leaves as an agricultural waste can be converted to woven mats and then used as a floating cover on water surface to reduce evaporation from small scale reservoirs. In this study, floating mats were made from date palm leaves and then used as a cover to reduce evaporation from pools filled with water. Only three identical pools were constructed at a selected site and the dimension of the pool was 10 m x 5 m x 1.5 m (Length x width x depth). Also, the impact of the floating mats on water quality was investigated. Data collected from the study site show that the reduction in evaporation from fully covered pool was about 63%, while that from half covered pool was about 26%. Results from water quality analysis show that the floating mats on water had no serious effect on water quality. Laboratory tests conducted on the samples collected from the pools reveal that the average dissolved oxygen (DO) concentrations were 6.2 mg/L and 8.1 mg/L for full and un-covered pools, respectively. These results confirm the successful use of the floating mats as an environmentally friendly cover for evaporation reduction with no harmful effects on water quality.

**Key words:** Agricultural waste, floating cover, evaporation reduction, water quality, arid region

# Technologies and Options for Secured Sustainable Competitive Energy in the 21<sup>st</sup>- Century

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## Abstract

Fossil fuels and nuclear energy contributes to 84.3 % of global energy supply. Their share will dominate for decades to come and also beyond 2050, while the share of renewables will certainly increase gradually and steady but they could substitute the fossil energy resource fully by the end of this century. Energy is the life blood of our society. The well-being of our people, industry and economy are depending on safe, secure, sustainable and affordable energy. Worldwide, energy consumption is the biggest source of human-caused greenhouse gas emissions which forms 76% from the total global emission (37.2% of which is GtCO<sub>2</sub>e). The energy sector includes transportation, electricity and heat, buildings, manufacturing and construction, fugitive emissions and other fuel combustion. In this study, The Energy Trilemma Index which is proposed by World Energy Council, WEC was used to rank countries on their ability to provide sustainable energy depending on three dimensions namely, energy security, energy equity (accessibility and affordability), and environmental sustainability.

**Key words:** Technology, sustainability, competitive energy, Energy Trilemma Index

# Innovating Practices, Applications, and Restrictions of Solar Energy in Sustainable Agri-food Production: An Overview

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## Abstract

Due to the increase in the world's population, worldwide food request is steadily growing, endangering food security as a vital piece for sustainable development. On the other hand, the pandemic shadows the global hunger increment. By relying on these, it is crucial to use sustainable and more efficient agri-food production techniques that are climate change-resilient. Nearly 25% of global green house gas emissions come from agri-food production systems associated with fossil fuels. Several approaches exist to maintain the energy-food sector's security that also works to diminish greenhouse gas emissions and fossil fuel alteration with renewable and sustainable low-carbon origins of energy. Among them, solar energy is considerably employed to provide the electric power and heat requests for various traditional and trendy agricultural chores. A review of the existing situation with solar energy application and its restrictions in agri-food production procedures is presented in this article. Furthermore, the progress of solar energy usage through coupling with sustainable agri-food methods is surveyed.

**Key words:** Solar energy, agriculture, Agri-voltaic, sustainable development, Energy-food nexus

# Technological Interventions for Sustainable Development: A Case Study

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## Abstract

Results of our Lab experiments on integrated nutrient management, water saving technology and crop diversification were demonstrated at farmers' field in 16 acres of land of 14 farmers in Kenthia village (Kharagpur Block-II, Paschim Medinipur). The land was barren for last 5-7 years without any crop cultivation even in rainy season. Lack of irrigation facility, farmers' knowledge about cropping system management, and smaller plot size, non-availability of labour are the major limitations of food production. As a result of successful demonstration of sustainable production technologies at the farmers filed average rice yield increased from merely 2.5 to 7.4 ton per hectare is a significant contribution in ensuring food security of villagers. Also the farmers could realize higher return from other crops such as sweet corn, peanut, and sesame with less fertilizer, labor and water besides improvement of soil health. The most important impact of this study had been is the change in the mind set of farmers that they can now grow other soil restoring crops, with less labour, water and fertilizer. Farmers had been planting only IR36 during *Kharif*, but introduction new varieties like Hybrid Bio-799 has yielded between 6.5 to 8.6 T ha<sup>-1</sup>. To have sustainable production, water saving rice production technology *i.e.* System of Rice Intensification (SRI), that saved 70-80 % seed and 25-30 % irrigation water requirement was introduced. Also Organic Farming technology was practiced in both SRI and conventional system for quality improvement in soil health and the food grain. Multiple options have been explored for nutrient management in both the types of transplanting.

Ponds not only used for fish cultivation but also for domestic uses. Ponds used to get dry in a few months due to leakage of water from the ponds. Treatment of farmer's ponds by applying bentonite clay to check the water losses through seepage has helped the framers to grow fish without any problem throughout the year. Farmers are now cultivating fish in pond and using the excess water for irrigation only in nearby field.

**Key words:** Technological interventions, sustainable development, SRI

# Role of Drone Technology in Smart Agriculture

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## Abstract

Drone technology is gaining importance in agriculture nowadays for effective utilization of natural and applied inputs to enhance crop production and productivity. Due to its feature of being airborne fitted with high resolution camera for image acquisition from the soil surfaces and plants growing in agricultural fields, the sensors fitted in the drone can provide information about the requirement of nutrients, water, plant protection against insect pest and diseases. Drone can be used to spray agro-chemicals like fertilizers, pesticides, fungicides precisely in agricultural fields as per crop needs. Drone technology not only improves overall performance but also helps farmers to overcome a variety of other obstacles and get several advantages from smart agriculture. Sensors and camera fitted in drone can overcome human mistakes and inefficiency in standard farming techniques. Drone technology is approaching a whopping business (\$1.3 billion). Drones generally contain a GPS, navigation system, several sensors, high-resolution cameras, controllers, programmable, and autonomous drone tools. The majority of farmers now use satellite photos as a starting point for farming systems. Unmanned air born drones collect exact data through agri-tech applications for precision farming than satellites. Drone technology has the potential to help farmers save time and boost efficiency. Agricultural drones could be used for soil and crop analysis to help in farm planning. It could be used to attach sensors that measure soil moisture content, topographical conditions, soil erosion, soil conditions, soil fertility, and soil nutrients. Drones can assist with the planting of crops and trees, which was previously done by farmers. Budget-friendly drones are projected to replace large tractors shortly, as they generate toxic gases and damage the environment. Drones can be used in tracking the impact of meteorological conditions and crop surveillance to secure a timely harvest. Continuous serves are required to soil and crop health which is time consuming difficult task which is error prone. Drones can complete the same task in only a few hours. Drones can acquire information about the condition of the land as well as the plant using infrared scanning. Drone technology has a bright future for its role in agriculture specially in climate change regime with unpredictable diurnal and seasonal variations to maximize production and productivity and therefore food security.

**Key words:** Drone, smart agriculture, sensors, camera, GPS

# Applications of solar energy in agriculture

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## Abstract

Solar energy is infinite, available in plenty free of cost and without any environmental pollution contrary to the fossil fuel-based energy sources like coal and gas. However, the solar energy is not utilized as it should have been mainly due to limitations of initial costs of solar panels, photo-voltaic batteries to store solar energy in the form of electricity and the efficiency of solar panels to convert sun energy into electricity as well as its transmission to grid or batteries. Researches are being done to lower the cost of solar energy production and its supply to household an industrial unit. In last one decade the solar energy production cost and regulations for its applications have been made user friendly at a much lower cost. The applications of nano-cells in the solar panels. The high-power batteries have increased the efficiency of solar panels to convert sun energy and transmitted to batteries which are durable, stable and long lasting. In agriculture, solar energy can be used mainly for irrigation pumps or solar driers to dry and preserve vegetables and food and running the fodder cutting machines or to prepare feed for animals. Likewise, solar based implements for churning the milk and lightning and operation tube-wells. Recently, solar panels are finding favours for facility of mobile charging. Solar driven tractors and combine harvesters are being developed for crop production managements practices. Thus, solar energy has immense potential in agriculture which calls for intensification of research and development activities through international corporations.

**Key words:** Solar energy, Solar Panel, Photo-voltaic battery, Solar pumps.

# Development and Evaluation of Improved Version of Scheffler's Solar Cooker at Lesser Costs

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## Abstract

To overcome the present energy problem especially after onset of Ukrainian war led energy crises, it is important to use solar thermal energy for practical solutions related to domestic and industrial purposes. This had led to the development of solar cookers. The first box cookers developed were less effective as the sunlight was not concentrated. In the 1980s, German Scientist Wolfgang Scheffler developed an alternative cooking method in north Kenya. It was also accepted in many developing countries because of advantages like ease of construction, easy access to hardware materials to build the system, and overall quality, and it was an open-source model. By 2004, approximately 750 models were developed across 21 countries. In 2009, Peter Schwartz examined different solar cooking technologies for developing nations based on the Scheffler model. The principle of the Scheffler concentrator and the satellite dish is similar; the only difference is that satellite dishes do not need to track the sun because they are in geosynchronous orbits. Today, Scheffler concentrators have been built from 0.5 to 50 m<sup>2</sup> in diameter size and used for low to medium temperature applications. Scheffler concentrators are capable of delivering temperatures in the range of 150–300. Material of construction for the concentrator can be glass, aluminium foil, aluminium sheet, etc. However, the cost of Scheffler Cooker is costly and beyond the reach of farmers and rural poor. Innovation is therefore needed to cut the cost while keeping the heating efficiency, performance and durability is high. This can be achieved by replacing high efficiency less costly concentrators, the material for parabolic structure, the motor of tracking of solar radiations etc.

**Key words:** Scheffler cooker, concentrator, geosynchronous orbits, heating efficiency

# A Study on Food Processing and Nutritional Value

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## Abstract

Food and nutrition security depends on the adequate supply of safe, affordable and nutritious fresh as well as processed foods to all the people. The challenge of supplying healthy diets to burgeoning population will in part be met through increase in food production. Equally important is reducing food losses throughout the supply chain and sustainable enhancements in preservation and nutrient content enabled by food processing. Processed foods provide important nutrients that may not otherwise be obtained in a household that has a limited food budget. From a nutritional standpoint, processed foods can provide key nutrients. Some nutrients like protein are naturally retained throughout processing, and others like B vitamins and iron may be added back if they are lost during processing. Fruits and vegetables that are frozen after harvesting can retain the majority of vitamins like vitamin C. Here the main focus is on the role of food processing on human health and food and nutrition security. There is a need to monitor the attitudes and values of consumers in order to better understand factors that may lead to negative perceptions about food processing. Food Processing Sector contributes about 32% of the valued food and grocery market in India. This sector is seen as the sunrise sector of the Indian economy and is the fifth-largest industry in terms of production, consumption, exports and potential growth. However, food wastage remains a concern as nearly 40% of perishables goes waste in India. Nearly 4 -6 % of cereals and about 20 % of fruits and vegetables are wasted. In the food basket, the energy and protein intake from cereals has decreased in both rural and urban India, largely because of increased consumption of other food items such as milk and dairy products, and the foods evolved due to changing food pattern such as fast food and processed food. Value addition, food processing and better post-harvest management practices can help in reducing these losses. The food production and the food processing sectors will be challenged to produce greater quantities of foods that are nutritionally appropriate for the promotion of health and well-being. Healthy and nutritious diets, which meet consumer expectations, produced from sustainable agri- food systems need to be delivered in a changing world with diminishing natural resources. An integrated multi-sectoral approach across the whole food supply chain is required to address global food and nutrition insecurity.

**Key words:** Food and nutrition security, adequate supply of safe, affordable and nutritious fresh, processed foods

# Impact of Direct Seeded Rice Technology on Environment and Economics

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## Abstract

Rice is one of the most important cereal crops of the world. It ranks first both in terms of area under its production as well as production. It is mainstay of about 50% world population for energy needs and hence a major element of international food security. Rice is grown in summer months in India when the evapotranspiration requirements of the crops are high. Moreover, about 3400 litres of water is required to produce one kilogram of rice. This has led to lowering the water tables in wells as well as deteriorating the quality of underground water. The situation in rice-wheat rotation areas is so grim that the Governments of Haryana, Punjab and Uttar Pradesh are coming up with the alternative plans for crop diversification through policy of incentives. Under such situations direct seeded rice technology offers immense potential to produce rice with considerably high saving of underground water. Also, this technology is less labour extensive as the process of transplanting is avoided and the paddy seeds in this system are directly sown by broadcasting or tractor mounted seed drills which saves lot of work and labour cost. Moreover, the emissions of methane and carbon monoxide from puddled transplanted rice are much higher. This has been the main reason for increase in greenhouse gases and consequent global warming. DSR technology avoids the problem of methane emission as the crop is grown in wet and dry cycles. In DSR, weed control is a bit problem and so is the problem of micronutrient deficiency. However, with the advent of agro-chemicals for pre and post emergence weed control, the problem of weeds can be tackled to a large extent. The most important agro-chemicals are pendimethalin and bispiribac. The yields of DSR rice are comparatively lower than the transplanted rice. However, with selection of suitable rice varieties and adoption of improved agro-technology competitive yields can be obtained. On economic scale DSR depending on the yield level is favourable mainly on account of less cost on raising nursery, puddling and transplanting the rice seedlings in transplanted rice system.

**Key words:** Direct seeded rice, transplanted rice, puddling, pendimethalin, bispiribac

# Chemical & Biological Matrix Mapping at Multiple Scales & Resolutions – Meeting Chemical Research Biology in Drug & Pesticide Discovery

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## Abstract

To assess and conclude what, when, why and which less is more relevant and what, when, why and which more is less relevant we need concurrence of multiple dimensions of research and development activities involved in Life Sciences applications. To acquire collectively the improved proficiency, extensiveness in experimental and operational setups the R&D team essentially need clear understanding and sound exposure in synchronizing sensor, signal, data, insight & basic science in tuned setup for transforming the idea to product.

We can achieve that tuning (physiological and chemical composition-based target/compound -detection, mapping and characterization) if we have a user intuitive, customisable and flexible framework that helps in optimally bringing the fusion of information and intelligence derived from multiple resources through natural as well as machine-oriented cognitions & recognitions at multiple scales and resolutions. The robust schema developed here solve the very purpose and evolved to operational level as packet solution for research and operational purposes especially for handling high throughput scientific loads in Life Sciences applications.

It has quite significant applications for agricultural, agrochemical, pharmaceutical, health-care (handling and processing clinical, oncology, medical, datasets as well as metadata) and allied industries during new molecule discovery, synthesis, formulations, testing, scanning, screening, validation and during trial-phases integrating invasive as well as non-invasive approaches. It helps in strengthening the various strategies related to technology selection, data acquisition, experimental design, deriving key signals as well as identifying hidden patterns & insights apart from optimizing cost, productivity and performance. It brings efficiencies in various forms while diagnosing pathology or bioefficacy in their early stages for pre-symptomatic or asymptomatic feature derivation and characterization.

**Key words:** Chemical matrix, Biological Matrix, Mapping, Multiple Scales, Resolutions  
Drug & Pesticide Discovery

## Social

### Mushrooms for Nutrition and Livelihood

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#### Abstract

Mushroom is an edible fungi which has immense nutritional value. It's a rich source of vitamin D3 and minerals besides energy. Mushrooms contain comparatively more amount of carbohydrates and proteins than fats. In Mushrooms, the quantity of unsaturated fatty acids like linoleic acid and oleic acid are more than saturated fatty acids namely palmitic acid. Mushrooms are also rich source of ergosterol, soluble vitamins, minerals and polysaccharides. Important bioactive compounds of mushrooms are antioxidants,  $\beta$ -glucans, terpenes and polysaccharides. The bioactive substances of mushrooms have roles in reducing diseases like Alzheimer, cancer, hypertension, heart stroke, Parkinson's and tumour. In this paper, the bioactive compounds in mushrooms and their roles in retarding deadly diseases of human have been highlighted. Mushroom cultivation has been adopted mainly in cooler ecologies. However, it's gaining momentum in other parts of semi-arid North West plain zones of India including Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Delhi NCR and other parts of India. Being a rural enterprise, it provides livelihood to millions of peoples directly or indirectly engaged in Mushroom cultivation. We at MM (DU), Mullana have established Mushroom cultivation unit and refined its production technology. This straggled spawning, sterilization of organic manures to be used for button growth, casing and harvesting technology have been perfected for higher yield and better quality of mushrooms and higher economical returns. Mushroom cultivation has relevance to food and nutritional security, self-employment and better economic returns for better socio-economic conditions of the farmers. Such aspects will be covered in presentation at the international conference.

**Key words:** Antioxidants, bioactive substances, immunity, mushrooms and nutraceuticals

# The Impact of Remittances on Poverty - Empirical Evidence from Afghanistan

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## Abstract

In this paper, I use quasi-panel data from the 2005-2012 National Risk and Vulnerability Assessment (NRVA) survey to examine the impact of international remittances on household poverty in Afghanistan. To estimate the causal effect as close as possible, this study applies propensity score matching to address household self-selection into international migration, beyond using a linear probability model with fixed-effects. I find that receiving remittances reduces the probability of falling into absolute poverty by 3 percentage points. However, the treatment effect on household poverty, as measured by caloric intake, is not statistically significant. Moreover, there is heterogeneity in the impacts of international remittances. I find a statistically insignificant treatment effect for urban households, while treated households in rural areas experience a significant and more pronounced effect. The results are robust to propensity-based weighted least square and also survive a series of robustness tests. The findings suggest that policies to facilitate foreign labor employment from urban areas may extend the desired effects to urban households. In addition, creating a competitive environment that lowers the cost of remittance inflows into the country may enhance the magnitude of the treatment effect.

**Key words:** Remittances, Absolute Poverty, Calorie Consumption-based Poverty, Rural, Urban, Afghanistan

# Social and Economic Dimensions of Self Help Group to Generate Livelihood Through Micro Finance in Rural Settings

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## Abstract

The money lenders and financial institutions like Banks have been s traditional source of credit for rural poor. However money lenders have been exploiting the credit seekers through very high interest rates whereas formal financial institutions have their own share of problems for their limited credit. Linked with microfinance approach, the Self Help Group (SHG) movement has now been accepted by all countries of the world as an effective strategy for poverty alleviation, income generating, empowering the poor and reducing unemployment. SHG linked micro finance includes such credits which are provided to the rural poor on easy terms and conditions and give access to several income generation activities such as animal husbandry and vegetable production in perry urban areas. Self - help group is a small voluntary association of poor people preferably from the same socio economic background. They come together for the purpose of solving their common problems. The Ms. Singh Enterprises provides financial assistance on returnable bases to such groups for small enterprises as corporate social responsibility. The implicit objectives are to increase people's participation through their empowerment generate livelihood and human resource development. The group contributes savings and thrift, invest the savings in productive enterprises or lend the saving among the group members. Diversification of microfinance activities will be worthwhile to ensure high output and intensified activities.

**Key words:** Self help group, micro finance, small enterprises, livelihood

# Double emotion work

## Women's experience in forced marriage

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### Abstract

The concept of emotion work, introduced by Arlie Hochschild (1983), has been used in many scholarly efforts. If we agree with Smith (1993) that most of the work done in this area is based on a concept of SNAF (Standard North American Family), it should be said that the emotion work of women in other minority groups or familial structures has been overlooked. Therefore, this article examines the emotion work and emotion management of women who have had forced marriages. Using qualitative data from two groups who have had forced marriages, I have presented the concept of a 'double emotional work'. Double emotion work implies a situation in which women, under conditions of forced marriage, do more emotion work to match and align their emotions and moods with the "feeling rules that tell them how marital relationship should be". The study also examines the clash between the feeling rules in the woman's premarital family and the feeling rules of her marital life.

**Key words:** feeling rules, emotion work, double emotion work, double sexual work

# Women Empowerment in Science and Technology

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## Abstract

In this Contemporary world, All we know up till now that there have been a lot of change which we all have witnessed some way or the other over the past few decades. Global community has made a lot of effort in inspiring and engaging women and girls in science. As, women and girls make up approximately 49.58% of the global population .we cannot afford to waste the talent of half of the world's population. it has been also demonstrated that when women contribute, with their particular perspectives, priorities and approaches to Research and Development, the questions asked, and the solutions created are more diverse and more societally relevant. Moreover, In the Developing countries women are also often involved in agricultural sphere and what not. In addition, most of women have additional burden, such as being the bread earner of the family. Specialists believe that true progress and development is not possible without women's active participation in these processes .The United Nations General Assembly declared 11 February as the International Day of Women and Girls in Science in 2015 so, as to encourage women to participate more in STI and make it a better place for every women, The gender dimension must be considered in all efforts aimed at opening science to society, so by educating and encouraging Men and boys to acknowledge and support the role of women in science and pave a better road for the future of girls and women, ensuring that meritocracy, hard work and perseverance, rather than gender, race or religion, are the driving forces in achieving success in scientific and engineering careers , This would make a gigantic difference at all levels of education, research and policymaking.

**Key words:** International Day of Women, gender dimension, women in science

# Women Empowerment in Agriculture, Science and Technology, Environment, Health Care and Policy Planning

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## Abstract

An empowerment means to authorize. When this is applied in the context of development of particular segment of population, here THE WOMEN, it means they have to be empowered to have control over their lives to better their socio economic and political conditions. Empowering women is a necessary right of women. Women needs to be empowered in various ways in different fields of society like:- **Agriculture:** - Women make essential contributions to the agriculture and rural economies in all the regions of the world. Various programmes allied to agriculture, soil conservation, daily development poultry, fisheries etc. need to be expanded to benefit the women in agriculture sector. **Science and Technology:** - Science and Technology can reduce household drudgery and provide better working condition for women particularly in rural areas. Greater involvement if women and development of appropriate technologies suited to them needs to be worked out. **Environment:** - Women's participation needs to be ensured in the conservation of the environment as the environment, a factor has an impact in their livelihood. In order to ensure efficient use of non-conventional energy sources, the women needs to be involved in spreading the use of solar energy, biogas etc. and other rural applications. **Health Care:** - Health care comes under social empowerment for women. A holistic to women's health which includes both nutrition and health services and their needs at all stages in the cycle needs to be adopted. Also women's traditional knowledge about health care needs to be recognized. **Policy Planning:** -Empowerment of women in politics and leadership is required for equal participation of women in decision making, democratic governance, peace building and stability in the entire region. Women should be equal with men in deciding for a better future for all. International community need to empower the women and should strengthen and accelerate their efforts to recognize the contribution being made by the women in these fields.

**Key words:** Women empowerment, agriculture, science and technology, environment, health care, policy planning

# Analysis of women domestic water consumption behavior and influencing social factors

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## Abstract

Optimal water management, especially when water resources are restricted, is of particular importance. Even though, the highest amount of water resources consumed in the agricultural sector, due to the chlorination process and the high costs of drinking water supply, appropriate management of drinking water plays a key role in the proper use of this limited and valuable resource. In this regard, the role of women as the most significant pillar of household consumption management, potential managers, and, actual directors of culture-building in society, are undeniable. For more than a decade, several countries in the world have tested the role of women in supplying, managing and protecting water resources and have benefited from its perks. Water consumption behavior is rooted in several cultural, social and economic factors. Identification and promotion of these factors are important aspects that can lead to more female involvement in the optimal management of water resources and reach more sustainability through this path. In this research, we tried to study the effective factors of domestic water consumption behavior among women. In other words, the present research seeks to answer the question of what factors affect women's water consumption behavior in the household sector. In this research, the navigation method has used. Using a multi-stage cluster sampling method, from a total of households living in Tehran, 450 women in charge of house management (mainly mother of a large family or daughter) selected as the sample of the study. The researcher-made questionnaire used as the instrument in this study, which comprised of several sections proportional to the dimensions of the survey. For analyzing the data of this questionnaire, SPSS software is used through some descriptive and inferential statistics. The results show that variables, including attitudes, age, socioeconomic status, have a significant relationship with household water consumption behavior. The results of regression coefficients also showed that attitudinal factors have the most impact in explaining water consumption behavior. In other words, for changing consumption behavior towards optimal use, changing attitudes is the most significant factor that can be effective in water resource management.

**Key words:** Water resource management, sustainability, women consumption behavior

# Need of the women Empowerment: A woman is a country's fate; do not put her life at stake

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## Abstract

Women Empowerment refers to the increasing the social, monetary, political and legal strength of the women, to ensure equal-right to women, also to make sure they are comfortable enough to say their rights, such as: freely live their life with a sense of self-worth, respect and dignity, have complete control of their life, both within and outside of their home and workplace, to make their own selections and decisions, have equal rights to participate in cultural, religious and community activities, have similar social status in the society, have equal rights for social and economic justice, determine financial and economical selections, get equal chance for education, get equal employment opportunity without the gender opinion, get safe and comfortable office Girls have the privileges to get their voices heard. Can certainly empowerment is not confined to downtown, working women, but in remote villages and villages, women remain very quick to hear their voices in culture. They are efficiently taking various careers to prove that they are not second to anyone by any means. But on this, women also care for their profession alongside which prevent the balance between their commitment with their home and family. Girl's empowerment is supplying legitimate power or authority to accomplish the tasks. If women were empowered they can be able to participate in the look and decision making task and contribute to the development programs and activities individually. Sexuality equality and can certainly empowerment are both human rights and are necessary for reaching comprehensive, neutral, and sustainable development.

**Keywords:** Empowerment, livelihood, social justice, economic independence, equality,

# Understanding the Nile Issue Under Historical, Economical and Climate Change Impact Perspectives

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## Abstract

The Nile issue has experienced different attention at different times starting from the middle ages until modern times. To understand the variation of attention and root causes arising from the Egyptian perspective it is worthwhile to analyze their old relationship. Though the White Nile and Blue Nile are shared by different riparian countries 85% of the water contributing to the Blue Nile flowing to Egypt originates from the highlands of Ethiopia. Egypt is a gift of the Nile is not only a slogan but understandable as Egypt is wholly dependent on the Blue Nile. But the controversy revolving around the Nile issue was aggravated during the course of history by global events like the textile industry propelled by the Industrial Revolution, and is closely connected to the American Civil War where Southern American States expanded slavery by the invention of Cotton Gin and Spinning Genny which revolutionized the fabrication of cloth. Also, the Ethiopian Church's affiliation with the Coptic Egyptian Church in Alexandria has fueled fears that if church leader, the Abuna, was not sent in time for Ethiopia, the Nile water could be withheld by Ethiopians.

Also colonial treaties, which have led to controversial discussions regarding the Nile water, also play a role in this context.

**Key words:** Nile issue, White Nile and Blue Nile, Ethiopian Church's, Nile water

# Role of NGOs and International Organizations Towards Sustainable Development

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## Abstract

For about several decades now, the humanity as a whole is quite concerned about the very safety and sustainability of the planet on account of the dangers posed by the blind race towards the abstract idea of development in the fields of science and technology which is mainly focused to stay ahead of the other to establish the superiority and domination. In today's organized world, divided in to independent nations and governed by sovereign governments, the first and primary responsibility for achieving common goals of humanity and the world as a whole is that of state governments. However, given the rivalry of nation's inter-se due to the domestic needs, safety concerns and ideological differences, the efforts are never sufficient. The economic condition and technological advancements of individual nations are some of the hurdles which prevent uniformization of policies towards sustainable development at international level. The issue of sustainability breaches the boundaries of nations, the walls of religion and the hurdles of different cultural approaches as the issue pertains to one and all irrespective of the place of residence, religious beliefs, customs or traditions of nation, communities and individual. The efforts of the governments of respective states/ nations have never been sufficient towards a balanced, systematic and visionary approach towards the goal of sustainable development. This is the reason that the participation of individuals/private organizations and government institutions is required for concerted efforts to towards the herculean task which seems not gettable by abstract efforts of individual or governments alone. In the modern times, NGO's, both domestic and international, have emerged one of very effective tools, given their expertise, resources, awareness of issue and their reach to masses within their respective areas of activities. Similarly, apart from the respective government of states, international organization do play a pivotal role not only towards bringing uniformity in the policy for a common agenda of sustainable development rising above the individualized interests of different nations but they also help in implementing the common agendas, rules, agreement and conventions thereby providing the necessary expertise and in helping out arranging resources for the same. NGO' and International organizations are not only playing a key role towards enacting and implementing actions and policies for a sustainable future without abandoning the goals of development but also proving to be indispensable tools without which sustainable development will be a distant reality.

**Key word:** NGOs, safety, sustainability, domestic and international, policies

# Water Management, Response to Climate Change (Drought/Flooding)

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## Abstract

**Water shortage and drought in Germany:** Hardly any rain for weeks and temperatures upto 40 degrees in Germany. Drought is also increasingly becoming a problem. Is Germany also running out of water? For some years now, we have been getting the impression from all sides that it is getting warmer and drier, as if we are heading for droughty times. Agriculture and forestry complain about too little rain. Dry forests, poor harvests and, above all, even poorer forecasts. The danger of forest fires is increasing, and what will become of the harvests in the future is apparently no longer really known. And even now, in spring 2022, only a fraction of the normal amount of precipitation is falling. Is Germany on its way to becoming a desert country: The hot and dry summers seem to be increasing in Germany! A comparison of precipitation amounts over the past ten years confirms the impression that the total annual rainfall has tended to decline. But a look at the weather records of the last 140 years reveals something surprising. On average, the annual rainfall has actually increased during this period. How can this contradiction be explained: Averaged over many years, more rain and yet a tendency towards more droughts: What will follow the 3 years of below-average rainfall cannot be predicted. However, rising average temperatures due to climate change and the shift in rainfall distribution from summer to winter further increase the risk of drought.

**Forecasts and Consequences:** Researchers already estimate that the climate has warmed by 1.5 degrees since industrialization. With 3 degrees more, the number of months of drought will increase significantly from an average of just under two to over three, which is very likely to happen before 2100. We will have to reckon with drought situations like those in the summers of 2018, 2019, 2022 and more frequently in the future resulting in water-stress, increased water consumption both in the private sector and in agriculture. Only timely irrigation could have kept the plants alive. The warmer it gets, the more water is needed, but the less is available. A paradox, a vicious circle, seemingly unsolvable. Currently, barely 3% of agricultural land in Germany is irrigated. According to forecasts, however, in 30 years more than a quarter of all fields could be dependent on irrigation. Does Germany need to fundamentally reorganize its water management: This entails serious impact on water-supply and sewer-management resulting in water-stress for various sectors from agriculture to all producing-, processing- and energy-industries. Existing sewer systems have to be adapted to the changing runoff and drained is charge situation. To maintain sustainability on the supply side, it is inevitable to take nationwide measures to secure ground water recharge and creation of water retention areas renaturation of water bodies. Another area would be the re-saturation of municipal water-supply systems as substantial water is lost due to leakage from water pipes.

**Key words:** Drought, precipitation, floods, water management, energy-industries

# Soil Dilapidation: A Interference in crop production

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## Abstract

Soil degradation denotes to decline in the soil's productivity through adversative changes in nutrient status, soil organic matter, structural qualities, and concentrations of substances. Soil squalor is a process, which lowers the current and future capacity of the soil to produce goods or services. It has also been defined as the rate of adverse alteration in soil qualities resulting in decayed in the productive capacity of land due to processes induced mainly by human involvement. Thus, it implies a decline in soil efficiency, a decline in vegetative cover, qualitative and quantitative debility of water resources, degradation of soils, and pollution of air. Degradation is a point of evolution that leads to a reduction of resources possible. About 7.40 m ha of arable lands globally turn into degraded lands yearly as a result of climate change and deforestation. The problem of soil dilapidation has been ever since the cultivation of soils started. However, it is greatly motivated in recent decades because of the increasing population of India at the rate of about 1.81%, per year requiring marginal areas to be brought under the plough to meet the growing food claim. Such marginal soils are particularly vulnerable to degradation, further lowering their quality and overall productivity. The present paper offers a brief account of degraded wastelands, causes, major threats, and organization options for combating soil degradation. It is estimated that out of 329 M ha<sup>-1</sup> total geographical area of India, the area under agriculture is 179.9 M ha<sup>-1</sup>, and 120.4 M ha area is degraded through one or more degradation types, which in turn, is eroding the country's productive resource base. It has been estimated, a total of more than 5000 tonnes of topsoil is being eroded every year. National Remote Sensing Centre prepared the wasteland, Atlas of India highlighting the different forms of wastelands there, nature and areas. The earliest assessment of the area affected by the land degradation made by the National Commission on Agriculture was 148 M ha, followed by 175 M ha by the Ministry of Agriculture (Soil and Water Conservation Division).

**Key words:** Soil degradation, water resources, wastelands