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A Voice for Agriculture

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MANAGEMENT OF HEAT WAVE CONDITIONS IN AGRICULTURE

A. Swetha, Srujana Puppala and K. Indudhar Reddy

Introduction

Climate conditions have a huge impact on agriculture. Extreme weather events, such as hurricanes, droughts, and heat waves, have risen in frequency and intensity. All these climatic changes are likely to have severe implications on agriculture production especially in the tropical and sub-tropical regions including India. Due to shortened crop duration and increased respiratory losses in plants, an increase in temperature is likely to have a negative impact on crop productivity.

World Meteorological Organization (WMO) described a heat wave as five or more consecutive days in which the daily maximum temperature exceeds the normal maximum temperature by 5° Celsius or if the maximum temperature of any place continues to be more than 45° Celsius consecutively for two days, it is called as heat wave condition.

Impacts of Heat wave in Agriculture

The impact of a heat wave on agriculture can be direct (physical damage to crops or trees by the extreme hydro-meteorological events) or indirect (loss of potential production owing to disturbed flow of goods and services, lost production capacities and increased cost of production). Heat wave impacts crop growth and development at different levels like soil moisture uptake level, root and shoot growth level, rate of photosynthesis level, respiration level, plant water uptake level and final yield. By hastening evaporation, a heat wave competes for soil moisture, leaving plants with almost no moisture to absorb. Heat wave also causes an overall environmental degradation which is a major factor contributing to the vulnerability of agriculture.

Rabi and summer crops are particularly hard hit by the heat wave conditions. Any extreme change in temperature would affect the productivity of crops. Heat waves can wreak havoc on late Rabi crops; rabi or boro rice is typically planted in November and harvested in May and have the impact of heat waves. High temperature affects the pollination stage of the paddy crop and as flowering stage is the most sensitive period to high temperatures, which lead to reduction in spikelet fertility especially in heat sensitive varieties. The heat wave has also been shown to have a substantial effect on crop production, both in terms of quantity and quality. Crop loss was primarily caused by flower drop and higher mortality of the pollen.

Management strategies to overcome the effects of heat wave conditions

- Introducing short duration varieties and temperature tolerant varieties.
- Advancement of planting dates of rabi crops in areas with terminal heat stress.
- Improving water use efficiency by advocating usage of micro irrigation (drip irrigation and sprinkler irrigation).
- Irrigate the crops during morning or evening hours only.
- Apply light & frequent irrigation to the standing crops.
- Increase the frequency of irrigation at critical growth stages.

- Improving the water holding capacity of the soil by applying coir pith or other oraganic matter before sowing of crops.
- Mulching with straw/polythene or undertake soil mulching to conserve soil moisture.
- Use of NAA, KCl and Cycocel to mitigate water stress.
- Use of Kaolin spray to minimize the damage of crops due to water stress.
- Grazing /feeding of cattle/goats may be done during morning or evening hours only and avoid during noon hours.
- Keep animals in shade and give them plenty of clean and cool water to drink.
- Cover the shed roof with straw, paint it white or plaster with dung-mud to reduce temperature. Use fans, water spray and foggers in the shed.
- During extreme heat, spray water and take cattle to a water body to cool off.
- Provide green grass to the cattle, protein-fat bypass supplement, mineral mixture and salt.
- Provide curtains and proper ventilation in poultry house.
- Protect the poultry birds by arranging fans and foggers in sheds, cover the sheds with paddy straw and arrange sprinklers. Feed with wet mash to increase the feed intake and provide cool water for drinking.

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Article Id:145

FARMERS CHOICE OF MUSTARD CULTIVATION IN TELANGANA – MANAGEMENT TIPS FOR HIGHER YIELDS

Srujana Puppala and Baby Akula

In India, among oilseeds, mustard ranks second in area (6.23mha) and production (9.34 mt) after groundnut, occupying 28.6% share of total oil seed production. In the state of Telangana, mustard is cultivated in an area of 3000 ha with 5000 tonnes of production as per Agriculture statistics at a glance, 2018-2019.

The area of mustard production has been gaining momentum in the state of Telangana, more so in the districts of combined Adilabad, Nizambad and Karimnagar for two major seasons one season being profitable yield by the farmers due to favorable weather conditions particularly during flowering stage. The other major reason is low water requirement being short duration (90-120 days). Thus, hither to, though mustard is a nontraditional crop, is gaining popularity as a substitute to chickpea in Telangana state. It is extensively used in making pickles and in seasoning of curries unlike in North India where, it is chiefly grown for cooking oil.

An effort has been for the first time to cultivate mustard during *rabi* season, 2020 at PJTSAU (Professor Jayashankar Telangana State Agricultural University), college farm to evolve better management practices suitable to mustard for higher yields

Sowing time: The ideal time for sowing of mustard is first fort night of October to first fort night of November.

Seed rate and sowing method: 2-2.5 kg per acre is the ideal seed rate. Seeds must be mixed in sand and placed in furrows.

Spacing: Spacing of 40 cm between row to row and 10 cm between plant to plant is followed.

Seed treatment: Seed treatment can be done with 3g captan per kg of mustard seed for controlling seed borne pest and diseases.

Varieties: Pusa Agarani, Varuna, Narendra Agati varieties are suitable for climatic conditions of Telangana. These varieties have 90-120 days duration and yields 6-10 quintals per hectare.

Pusa Agrani: This is the variety which is suitable for sowing from first fort night of October to first fort night of November. It takes 100-110 days to achieve maturity.7-8 quintals per hectare yield can be obtained and 40% oil content is present.

Varuna: High yielding variety which comes to maturity in 135-140 days with 43% oil content.

Narendra Agati: This variety comes to maturity in 120-130 days and yields 8-15 quintals per hectare.

Season and Climate: In comparison to other rabi crops, mustard is more sensitive to climate. 15-250c temperature is most suitable. Cold temperature, solar radiation and adequate moisture are favorable for increasing oil content. At anthesis (40-50 days after sowing) high moisture, snow and rainfall will injure mustard crop. Annual rainfall of 600-1000mm is good enough. This crop is sensitive to high water logging, so irrigating the soils properly with adequate drainage is necessary.

Soils: Sandy to heavy clay soils are suitable for cultivation of mustard crop and alluvial soils are best suitable for higher yields.

Fertilizer management: In mustard crop, fertilizer management is of key importance for better yields. Based on soil testing recommendations, fertilizer application should be done. 2-3 tons of farm yard manure per acre can be applied to improve organic content of soil, which in turn improves nutrient status of soil. 24:16:16 N-P_2O_5-K_2O kg per acre can be applied during the crop growth period. Nitrogen is applied in two splits, at sowing and pre flowering phase (40- 50 days after sowing), while Phosphorous and potassium, were applied at the time of sowing as a single dose.

Thinning: Thinning was done at 15-20 after days sowing in such a way that only one plant per one hill is maintained for better growth and establishment of crop.

Weed management: Intercultivation has to be followed at 20-30 days after sowing for controlling weeds. Pre Emergent (PE) spray of trifluralin @ 400 ml per 200 liters of water per acre can be done.

Water management: As moisture is necessary for germination of seeds, a pre sowing irrigation should be given. Mustard crop requires water requirement of 300-400 mm. Mustard crop can be grown on residual moisture of previous crop, so it is suitable as *rabi* crop. Three to four irrigations are required for better yields of mustard crop. Critical growth stages for mustard crop are branching (20-30 DAS), flowering (40-50 DAS) and fruit setting (60-80 DAS). In case of three irrigations, irrigation at all the critical stages can be done. In case of 2 irrigations, irrigation at flowering (40-50 DAS), and fruit setting (60-80 DAS) is preferred. In case of single irrigation, irrigation at flowering (40-50 DAS) is preferred. Mustard crop is sensitive to water logging and leads to yield reduction. Drainage channels should be maintained to drain excess water.

Drip irrigation method: Water use efficiency and fertilizer use efficiency can be enhanced through drip irrigation method. Best yields can be obtained by adopting drip irrigation method. Irrigation once in two days, through drip irrigation can lead to higher yields.

Crop pattern and Intercropping: Mustard crop can be sequenced with kharif crops like maize, cotton, pulses. In rainfed situations four rows of chickpea and one row of mustard intercropping resulted in good yields.

Plant protection

Saw fly: This insect ruptures leaves as minute holes by biting the leaves and defoliates all the plant parts. For controlling saw fly, Acephate 1.5g per liter water can be sprayed to the crop.

White rust disease: White creamy yellow raised pustules appear on the leaves which later coalesce to form patches. Dusting of sulphur can prevent and treat rust fungus. Neem oil, a botanical fungicide and pesticide, also controls rust.

Harvesting: Harvesting should be done when 75% of the siliqua become golden yellow in color. The harvested plants are heaped and dried under the sun for 4 – 5 days to attain 12 – 13% of moisture level. Threshing is done after 10 – 12 days by hand using stick. Threshed seeds are cleaned by winnowing and sieving using suitable size of sieve.

Yield: By following recommended package of practices, 4-5 quintals per acre can be obtained.

MANAGEMENT PRACTICES IN MUSTARD CULTIVATION FOR HIGHER YIELDS

Land preparation

Sowing

Fertilizer application

Thinning

Weed management

Irrigation management

Drip irrigation in mustard

Harvesting

Saw fly

White rust

Mustard crop at flowering stage

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TRAMMEL CLIMATE CHANGE AFTER COVID-19? FAST-GROWING INDIA IS KEY!

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Introduction

India is one of the fastest-growing economies in the world—also have the third-highest number of COVID-19 cases (Krishnasamy *et al*., 2020). Now a days it is facing pressure to launch recoveries after the economic devastation caused by the pandemic. Will they backslide on India's Paris climate agreement commitments, or will the expected return of the United States to the pact provide some needed encouragement to treat the pandemic crisis as an opportunity to build a more sustainable economic future. The United States and other signatories would need to re-embrace a global leadership role on climate change and engage with leaders to reverse recent trends in India (Dent, 2000). With the right support, however, India could leverage their displaced workers, many of whom work in the informal economy, to fuel a green recovery.

Current scenario in India

India is facing tremendous climate change risks to food security, access to shelter, and the livelihoods of their most vulnerable communities and it also has large informal labor markets: Around 80 percent of India's 500 million labor force are estimated to be employed in the informal sector—meaning their jobs have no contract and often provide low pay, unsafe working conditions, and no social safety net (Yadav and Lal., 2018). The pandemic has made such economically vulnerable people more so. But the path forward need not be seen as an either-or. The environmental imperative can be the cornerstone for COVID-19 economic recovery. India's commitment to the Paris climate agreement includes a pledge to reduce carbon emissions by over a third by 2030 (from 2005 levels), as well as a commitment to 40 percent of power generation from renewable sources. India has made steady investments in renewable energy resources and created jobs in that sector, but the country also faces critical constraints and has not moved away from relying on coal as a major source of energy (Jassanoff *et al*., 2020). Drawing on previous work that has examined this issue, we identified three ways India might reskill a portion of their informal workforces to fuel a more environmentally sustainable economic future and fundamentally change the trajectory of global climate change.

Train Workers to Build and Improve Infrastructure

A shift to a "greener" economy will require improvements, repair, and construction of infrastructure. This includes investments in wastewater management, sustainable agriculture, and retrofitting buildings with renewable energy sources. Vocational training institutions can prepare displaced workers to fill such jobs through short-term training courses that grant credentials that they can use to continue their training should they choose to remain in this field.

Support Sustainable Livelihoods in Rural Areas

A large but declining share of the labor force of India (over 40 percent) are employed in the agricultural sector. In addition to incorporating innovations in pest management, water use, and other sustainable farming practices, training could be directed toward farmers and rural residents, including displaced migrant workers, for jobs in forest restoration, solar-powered energy installation, and other similar renewable-based initiatives in rural areas.

Support Eco-Friendly Entrepreneurship

COVID-19 may obliterate previous income-generating business activities. India can use this opportunity to develop policies that encourage small-enterprise growth, especially the creation of sustainable, eco-friendly businesses. India could use help and expertise from developed countries on this front, such as financial incentives, access to low- or zero-interest loans, and technical support and training.

India has large economies, among the top 10 in the world, and sizable workforces devastated by the pandemic. It also face enormously high stakes with extreme weather events attributed to climate change likely to worsen over time. Will they take this moment as an opportunity to integrate climate action into their post–COVID-19 economic recovery plans? Much will depend on the leadership role that the United States and other developed countries choose to play.

India is one of the largest and fastest-growing economies in the world—also has the third-highest number of COVID-19 cases and it is also facing pressure to launch recoveries after the economic devastation caused by the pandemic. Will they backslide on their Paris climate agreement commitments, or will the expected return of the United States to the pact provide some needed encouragement to treat the pandemic crisis as an opportunity to build a more sustainable economic future?

Conclusion

The United States and other signatories would need to re-embrace a global leadership role on climate change and engage with leaders to reverse recent trends in India. With the right support, however, India could leverage their displaced workers, many of whom work in the informal economy, to fuel a green recovery. India is facing tremendous climate change risks to food security, access to shelter, and the livelihoods of their most vulnerable communities and it also have large informal labor markets: Around 80 percent of India's 500 million labor force are estimated to be employed in the informal sector—meaning their jobs have no contract and often provide low pay, unsafe working conditions, and no net. The pandemic has made such economically vulnerable people more so. But the path forward need not be seen as an either-or. The environmental imperative can be the cornerstone for COVID-19 economic recovery. India's commitment to the Paris climate agreement includes a pledge to reduce carbon emissions by over a third by 2030 (from 2005 levels), as well as a commitment to 40 percent of power generation from renewable sources. India has made steady investments in renewable energy resources and created jobs in that sector, but the country also faces critical constraints and has not moved away from relying on coal as a major source of energy

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Article Id:147

COTTON STALKS RESIDUE MANAGEMENT – AN INNOVATIVE APPROACH TO ENHANCE SOIL PRODUCTIVITY

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Cotton is the most important commercial crop across rainfed growing regions in India. Apart from fiber, it provides gainful employment to millions of people in country who are engaged in its cultivation, trading, processing, manufacturing and marketing. In India, it was cultivated in an area of 12.58 M ha producing 37.0 M bales with an average kapas productivity of 500 kg ha-1 during the year 2017-18. (Agriculture at a Glance, 2017-18). In Telangana state, cotton is cultivated in an area of 1.9 M ha with a production of 5.44 M bales with an average kapas productivity of 488 kg ha^{-1} (Directorate of Economics and Statistics, 2017-18).

Cotton produces kapas which has wide variety of uses in industry. Besides, it leaves lot of residues which include stalks, locules, leaves and roots in the field after picking kapas. A huge quantity of residue is being generated across different cotton growing states in India and a large portion of it is being burnt on-farm primarily to clear the field for sowing of succeeding crops and for clean cultivation.

In India, annually, 683 million tons of crop residue is generated, of which 178 million tons is generated in Telangana state. But, disgustingly, 48.9% of crop residue being burnt across the country. While, in India and Telangana, cotton crop generate nearly 25-30 MT and 4.0-5.0 MT of stalks, respectively with an average stalk production of 2-3 t ha^{-1} (www.agri.telangana.gov.in) , which is also largely burnt without effectively utilizing as an organic source to enhance soil productivity. Moreover, valuable plant material is being lost which otherwise can be used for productive purposes.

Cotton stalks contain about 67.3-70% hemi cellulose, 24.3-28.2% lignin and 5.9-8.3% ash. They are rich in nutrients with 51.0% C, 4.9% H, 0.62-1.0% N, 0.61-0.68% K, 0.08-0.1% P, 0.43% Ca, 0.15% S and 0.12% Mg, 324 ppm Fe, 147 ppm Mn, 27 ppm Zn, 9 ppm Cu and 1.6 ppm of Mo (Dubey *et al*., 2004; Sutaria *et al*., 2016). So, burning leads to loss of these valuable nutrients. Instead, if composting is done, nutrients can be recycled. Sutaria *et al.* (2011) concluded that the recycling of cotton stalk (which are either burned or wasted) by chopping in to small pieces of 5-6 cm using cotton shredder and composting with addition of compost culture at 500 g per tonne, urea (N @ 0.5%), cow dung @ 20% as well as Azotobacter and PSM @ 500 g each per tonne during first turning of cotton stalk, which resulted in enriched compost with higher content of all plant nutrients in less than 120 days.

Disadvantages of burning cotton stalks:

Burning of any crop residue in general and cotton stalks in particular is laborious, time consuming (Fig.1 and Fig.2) and costly (Rs.4375 ha^{-1} for cotton), besides causing following harmful effects.

1. Leads to environmental pollution
2. Emissions of greenhouse gases like CO_2, NOx, SOx, NH_3 and volatile organic compounds (VOCs)
3. Compounds the problem of air pollution in urban areas
4. Finally, it leads to global warming and climate change
5. Heat generated due to burning kills soil microorganisms and eco-friendly insects too

Fig. 1. Stalking of cotton stalks before burning

Fig. 2. Pollution due to cotton stalk burning.

Hence, alternative approach of *insitu* incorporation of cotton stalks residue is gaining importance using tractor operated cotton stalk shredder cum *insitu* applicator (Fig 3.).

Fig. 3 Tractor operated cotton stalk shredder cum *insitu* applicator

Advantages of incorporating cotton stalks in soil:

1. Better moisture conservation
2. Low erosion due to low runoff
3. Low GHG's (Green House Gases) emissions
4. Moderation of soil temperature
5. Better aggregation of soil particles

6. More hydraulic conductivity
7. High quality organic matter and greater soil C (Carbon) stock
8. Nutrient recycling and better availability
9. Higher microbial activities
10. Better root proliferation.

Thus, incorporation of cotton stalks serves as a store house of nutrients, and subsequently enhances fertility and productivity of soil as stated by Senthilkumar and Kasthuri, 2015. Operation with cotton stalk shredder cum *in situ* application recorded favourable increase in hydraulic conductivity (1.38 to 2.30 cm hr^{-1}), decrease in bulk density (1.33 to 1.25 Mg m^{-3}), increased available N (199.0 to 252.0 kg ha^{-1}), P (12.6 to 20.1 kg ha^{-1}), K (541.0 to 640.0 kg ha^{-1}) and organic carbon content (0.36 to 0.54 kg ha^{-1}) of the soil.

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POST-HARVEST MANAGEMENT OF AGRICULTURAL CROPS

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Abstract

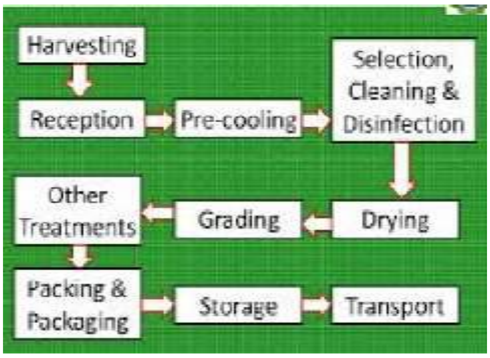
Minimizing farm product loss or wastage remains the ultimate aim of post-harvest management strategies. In the current situation of growing population and declining agricultural land and other resources, post-harvest management has attained the central stage. Currently, the most pressing global challenge is to ensure food protection that is both healthy for humans and sustainable for the world. Agricultural crop production has increased dramatically in recent years, but post-harvest technology advancement and implementation have lagged, resulting in massive losses after harvest. Mechanical, microbial, and physiological losses cause 16-36 percent post-harvest losses in fruit crops every year. Horticultural produce, for example, needs a lot more effort and techniques to ensure processing promotion and added value. In order to improve food safety and enhance national food security, the manufacturing value chain has become a requirement.

Keywords: Post-harvest, quality, waste utilization.

Introduction

One of the most pressing global issues today is how to ensure global food security. Growing population thus maintaining long-term sustainable sustainability, making it a key component of the philosophy of sustainable development. Since, according to the FAO, food production would need to rise by 70% by 2050 to feed the world's population of 9 billion people. External factors such as mechanical damage (bruising, cutting, fracturing, impact wounding), parasitic diseases (fungi, bacteria, other organisms), and internal factors such as physiological degradation, mineral deficiency, low or high temperature injury, or undesirable conditions all contribute to post-harvest losses. Post-harvest losses, which range between 24 and 40 percent in developing countries and 2 to 20 percent in developed countries, are a major waste source. High levels of waste result in higher fresh produce costs, putting farmers in jeopardy.

Harvesting



a mission Harvesting is critical to product quality and post-harvest life. Understanding the maturity of the items to be harvested is critical to comprehending the situation. In addition, the harvesting method has a significant impact on the post-harvest management of the crop. Physiological maturity: In non-climacteric fruits, reaching maximum stage growth just before ripening or maturing. Produced fruits and vegetables for seed production, for example. Horticultural/commercial maturity: stage of growth and development that is suitable for a particular use (consumer / market-oriented). Fresh canning, dehydrating vegetables, IQF (Individual Fast Frozen), and local or remote market harvesting are some examples.

Pre-cooling

Immediate cooling of the commodity to its optimum storage temperature for removal of field heat is the most efficient and well-established method for extending the storage life of fresh horticultural perishables. Protocols designed to pre-cool mango, apple, banana, and stone fruits, among other fruits, need to be refined further for commercial adoption. To ensure fast refrigeration and high RH, pack the items with crushed or flaked ice. In the farmers' fields, products can also be stored in the shade.

Ripening

There is a wealth of information available on the physical and chemical changes that occur during fruit ripening, particularly in regards to polysaccharide hydrolysis and the function of ethylene, among other things. Artificial ripening of bananas with 500 ppm etheral dip or spray and storage at 18-20oC has been found to produce uniform maturation in the Cavendish group of bananas. While few large businesses use maturing chambers to ensure standardised banana maturation, such facilities are out of reach for small farmers.

Sorting and grading

Fruit grading is often performed manually in India and is dependent on scale. Growers typically hire professional packers who rate the fruit based on their previous experience. In the region, expanding belt style graders, mechanised sorting, washing, wax coating, and size grading units were created for Nagpur mandarin, mosambi, and kagzi lime. With raw cashewnuts, a mechanical black pepper grader is used. The onion is halved, and the spherical fruit is graded. Mango fruit grader and sapota fruit grader. To minimise losses and ensure good returns, a complete packaging line with size grader, de-saping unit, hot water treatment unit, cleaning, sponging, waxing, dehydration, and mango packaging can be used.

Packaging

Packaging is an important part of the marketing of fresh horticultural products because it serves as a key connection between the producer and the customer. Overall, fruits and vegetables are packaged without any pretreatment on the farm. Some are also shipped unpackaged, like tomatoes. Vegetables such as cauliflower, peas, and other uneditable portions are transported in large quantities from the field to wholesale markets. Removing these non-edible parts before marketing will save money on transportation and reduce emissions. Many fruits and vegetables, such as citrus, mango, cull apples, and beans, peas, onion, garlic, okra, and potato, are commonly packaged in traditional packaging types such as bamboo baskets, wooden baskets, and gunny bags. To reduce the forest load, corrugated fibre boxes are also used to pack apples, oranges, grapes, stone fruits, sapota, and other fruits. The greatest benefit of packaging is that it protects a fresh product from physical harm caused by inadequacies in handling and transportation. Additional advantages of packaging include: barrier protection against product degradation by harmful environmental agents such as dust and microorganisms; no use of products to produce relatively small units of products that are simpler and faster to handle than unpackaged goods; and no use of products to create relatively small units of products that are easier and faster to handle than unpackaged goods. It also makes better use of storage and transportation capacity. Trading help that provides a standard size unit for market trading, removing the need to weigh or count all traded goods. By showing basic market details on the packaging as well as appealing designs, marketing assistance is provided.

Storage

Due to wide differences in temperature and humidity between the growing fields and the market place, storage losses of fruits and vegetables are high in the case of distant marketing. The lowest temperature is the temperature at which fresh fruits and vegetables are stored because they are not chilled. Apples can be stored at 1.7-3.3 degrees Celsius, bananas at 12.8 degrees Celsius, grapes at 0-1.7 degrees Celsius, guava, mango, and pineapple at 8.3 degrees Celsius, and oranges at 5.5 degrees Celsius. When combined with low temperatures, controlled or modified atmospheres significantly delay respiratory activity and softening, senescence and quality changes of stored products.

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Article Id:149

ABIOTIC STRESS MANAGEMENT IN RICE

A. Swetha Srujana Puppala And K. Indudhar Reddy

Introduction

In today's climate change scenario, crops are exposed more frequently to episodes of abiotic stresses such as drought, salinity, elevated temperatures, submergence and nutrient deficiencies. Abiotic stresses are believed to cause major problems in agriculture by reducing crop growth and productivity. Because of their sessile nature, plants must endure adverse environmental conditions and consequently evolve a variety of responses to acclimatize to environmental stresses. Different abiotic stresses and its effect on growth and yield attributes of rice:

- High and low temperatures
- Drought
- Salinity
- Submergence
- Acid sulphate soils
- Green-house gases
- Nutritional deficiencies

High and low temperatures

The response of rice to high temperature differs according to the developmental stage with high temperature tolerance at one developmental stage may or may not necessarily lead to tolerance during other stages. The crop growth cycle of rice can be broadly divided into three stages namely vegetative growth, reproductive stage and grain filling or ripening stage. During vegetative stage, temperature beyond the critical limit could reduce plant height, number of tillers and total dry matter accumulation. Anthesis/flowering is the most sensitive process during reproductive stage to high temperature. Decreased grain weight, reduced grain filling, higher temperature of white chalky rice and milky white rice are common effects of high temperature exposure during grain filling stage in rice. Low temperature is a major environmental factor causing reductions in yield. The common effects of cold injury during nursery will be low germination, slow growth of seedlings, leaf yellowing and stunted growth.

Drought stress

Drought is the major constraint to productivity and the cause of yield instability in rainfed lowland rice.Agriculture drought occurs when soil moisture is insufficient to meet crop water requirements resulting in yield losses.Drought affects all growth stages of rice growth and development and water stress especially during flowering stage depresses grain formation much more than drought at other reproductive stages.The strong effects of drought on grain yield are largely due to the reduction of spikelet fertility and panicle exertion.

Salinity stress

Salt stress is another major constraint for rice production because modern rice varieties found highly sensitive.Rice is comparatively tolerant to salt stress during germination, active tillering and maturity stages whereas sensitive during early seedling and reproductive stages.Yield and grain quality of rice greatly influenced by salinity as salinity hampers growth, photosynthesis and net assimilation rate.Along with the vegetative stages, salt stress affects reproductive stage of rice that reduces yield, yield contributing parameters and grain quality.

Submergence stress

Submergence is a condition where the whole plant is immersed in water and thereby exposed to stress conditions.It deprives the plants from free atmospheric oxygen and reduces the rate of photosynthesis and respiration.Submergence disturbs the morpho-physiological growth and development of rice plant.

Acid sulphate soils

Acid sulphate soils (ASS) are characterized by oxidation of reduced S-compounds producing sulphuric acid and pH values below 4. The sulphuric acid leaks into the surface water and attacks clay minerals liberating toxic amounts of metal ions, such as aluminium, iron, potassium and manganese. Usually these type of soils have nutrient deficiency especially in phosphorus, which causes poor plant growth and development.

Green-House gases

The natural as well as anthropogenic activities have serious effects on the green-house gas (GHGs) emissions that include ever increasing concentrations of CO_2, methane (CH_4), nitrous oxide (N_2O) and ozone (O_3). Among the GHGs, CO_2 is mostly originated from industrial activities, including burning of fossils fuel. CO_2has a significant impact on agricultural production and productivity. The major effect of elevated CO_2 is on net photosynthesis by suppressing photorespiration.

Nutritional deficiencies

A number of integrated factors which influence nutrient availability to plants resulting in nutritional disorders. The deficiency and toxicity of macro and micronutrients in soil may arise due to:

i) natural supply of nutrients;

ii) adverse soil conditions such as excessive acidity, alkalinity and salinity;

iii) relative activity of micro-organisms which play a vital role in nutrient release;

iv) addition of fertilizer;

v) weather conditions.

Severe deficiencies (in some cases hidden hunger) and toxicities can be identified by visual symptoms, clearly examining and differentiating from disease symptoms.

Management options for Abiotic Stresses

- High and low temperature:
  - Develop heat and cold tolerance varieties at flowering;
  - Improve transpiration cooling mechanism for leaves.
- Drought:
  - Improve life-saving irrigation infrastructure such as tank;
  - Develop drought tolerance short duration varieties with seedling vigour.
- Salinity stress:
  - Develop salt tolerance in rice;
  - Improve leaching;
  - Apply gypsum;
  - Improve various agronomic practices;
  - Improve water and salt management strategies.
- Submergence:
  - Develop tolerance for submergence;
  - Proper water management at river basin level.
- Acid sulphate soils:
  - Short duration varieties and seedling vigour;
  - Proper drainage;
  - Apply lime.
- Green-House gases:
  - Improve environmental quality;
  - Develop CO2 responsive rice varieties.
- Nutritional deficiencies:
  - Develop nutrient responsive cultivars;
  - Crop residue management.

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HYDROPONICS FARMING IS BOOM OF FUTURE AGRICULTURE IN INDIA

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Introduction:

Hydroponics is a type of horticulture and a subset of hydroculture which involves growing plants (usually crops) without soil, by using mineral nutrient solutions in an aqueous solvent. Terrestrial plants may grow with only their roots exposed to the nutritious liquid, or, in addition, the roots may be physically supported by an inert medium such as perlite, gravel, or other substrates. Despite inert media, roots can cause changes of the rhizosphere pH and root exudates can affect rhizosphere biology. Hydroponics is a revolution in agriculture, where plants are grown in a nutrient solution without soil. There are many advantages of soil-less farming over conventional soil farming. The land requirement is quiet low; plant growth rate is high so high yields, off-season production, less water consumption, pesticide free, and no real dependency on the weather if it's a high-tech farm.

Hydroponic farming is setting its roots all across India. A hydroponic system with greenhouse farming, together they are taking the urban farming to a next level. It is a profitable business to set up hydroponics in India. There are many factors such as large population which makes the prospect of high market growth rate, rich climatic conditions, presence of favorable labor cost and intelligent human capital. Also, the hydroponic methodologies, food safety, pest management and other essential farming expertise, already exist in the market. Moreover, hydroponics is the need of the hour, as due to growing population and urbanization the free land area is diminishing. Urban hydroponic growers are making it possible to eat fresh, pesticide-free produce, high yields, with no soil use.With few exceptions everything and anything can be grown using hydroponics. If wish to do it on commercial level then there are two major factors to take into consideration - free space and budget, depending what you want to grow and which system is required to be installed for it. You can start hydroponic farming in your garden as well.

Population size of India is indiscriminately increasing, and this is one of the major reasons why size of arable land is reducing in availability. Since arable land area is continuously reducing, it is becoming difficult to produce staple crops for rapidly growing population. With hydroponic farming method, the arable space problem in India will be solved in the future. More cultivars of staple crops can be grown, and consumption of soil and water will be reduced, or just not required.

How it would appear, when crops will be grown in visible light spectrum, and there will be fresh food available for everyone on the land. This could be a start of new green revolution; which millennia's out here are going to witness. Another significant benefit of

Hydroponic farming evolution in India will alleviate the burden on poor people and the environment in which we breathe and survive. How this will happen? Since hydroponic farms requires less of space and water, and growth is alarmingly quick than the traditional farming, fruits and vegetables will be grown quickly. With surplus food available for everyone, there will not be fight for the hunger. In this innovative process water is also saved, which means more water is available for various other purposes.

There are numerous success stories of farmers growing their crops hydroponically. Market research shows that the global hydroponic market will grow at a compound annual growth rate of 22.5% between 2019 to 2025 due to the increasing demand for hygienic and hydroponically grown fruits and vegetables.

As the crop production is often limited by environmental factors, interest in alternative farm practices is increasing. In this regard, hydroponic farming serves as a promising farm practice that offers a solution for some serious challenges of crop production such as:

- Lack of arable land
- Climate change
- Deforestation
- Rising fossil fuel prices
- Ecosystem degradation
- Rise of water and food scarcity

In this regard, hydroponic farming as a soilless farm practice directly eliminates the dependence of crop production on the soil as one of the primary resources.

Hydroponic Farming?

Hydroponic farming is the practice of growing crops by using mineral nutrient solutions instead of soil to deliver water and minerals to the crop roots. Traditionally, the soil supports the crop's roots by helping them remain upright and ensuring the delivery of water and essential nutrients. In hydroponic farming, crops are supported artificially. Therefore, the nutrients are supplied by using various practices that bring mineral nutrient solutions to the crops.

Basic needs for Hydroponic Farming

Fresh water. Were talking primo, filtered stuff with a balanced pH. Most plants like water with a pH level around 6–6.5. You can adjust the acidity of your water with over-the-counter solutions found at your local hardware, garden, or hydroponic store.

Oxygen. Don't drown your plants! In traditional farming, roots can get the oxygen needed for respiration from pockets of air in the soil. Depending on your hydroponic setup, you will either need to leave space between the base of your plant and the water reservoir, or you'll need oxygenate your container (think of bubbles in a fish tank), which you can accomplish by buying an air stone or installing an air pump.

Root Support. Even though you don't need soil, your plant's roots still need a little something to hold on to. Typical materials include vermiculite, perlite, peat moss, coconut fiber, and rockwool. Stay away from materials that might compact (like sand) or that don't retain any moisture (like gravel).

Nutrients. Your plant is going to need plenty of magnesium, phosphorus, calcium, and other nutrients to stay healthy and productive — just like plants growing in the ground need healthy soil and fertilizer. When you're growing plants without soil, this "plant food" must be included in the water that's feeding your plants. While you can technically make your own nutrient solution, it's easy to buy mixtures online and in stores.

Light. If you're growing your plants indoors, you might have to invest in some special lighting. Each kind of plant will have a different requirement for the amount of light it needs and for the placement of lights (typically referred to as Daily Light Integral or DLI).

Types of Hydroponic Farming

There are various types of hydroponic farming. Hydroponic farms can be set outdoors, as well as indoors within greenhouses, or in a completely controlled environment by using artificial light.

There are the two main types of hydroponic farming systems:

- Passive system uses a growing medium to retain moisture and supply the nutrients
- Active system brings the water and nutrient solutions by utilizing the pipes

Finally, there are many variations and possible settings for hydroponic farms. However, the most popular hydroponic farming types are:

Wick system: the passive system, meaning there are no floating parts; the crops are supported by ordinary trays or other growing mediums (perlite, vermiculite, or coconut fiber); the nutrient solutions are supplied from the reservoir with a wick.

Water culture system: the simplest of all active hydroponic systems, the roots of the crops are completely immersed in the water; the platform that holds the plants floats directly on the nutrient solution; an air pump supplies the oxygen and the nutrient solution to the plant roots.

The most successfully grown crops through hydroponics in India are:

1.Tomatoes

Many types of tomatoes, including traditional and cherry, have been grown widely. They need a growing medium for plant support, pH level 5.5-6.5 and require more sunlight. A wick system or Ebb and flow systems work excellent for tomatoes production.

2. Microgreens

Microgreens are quite popular in the younger generation for their high nutritional content. The reason behind calling them microgreens is that they are physically smaller than the matured plant. The microgreens prove to be a better choice when grown commercially, restaurants being the largest marketplace, can buy microgreens at the rate as high as Rs 150-200 per 100gm of microgreens. The advantage of growing microgreens is that they get ready for harvest in just one to two weeks and requires comparably much smaller space for their cultivation.

3. Lettuce, Radish & Spinach

With hydroponics a cold weather crops like lettuce is being produced throughout the year by maintaining a cool temperature and 6-7 pH level. Hydroponic systems like Nutrient Film Technique (NFT), Deep Water Culture (DWC) and an advanced version called Aeroponics , are best for plants like lettuce, radish, spinach, and other leafy vegetables, as they have shallow roots, short above ground height and take less time to mature. So with controlled favorable conditions one can get round the year crop.

4. Tulips

Tulips are among the most expensive flowers in the world. In India, the price for one tulip flower ranges between Rs 70-100 and a bunch of tulips may cost around Rs 600. The reason tulip has such a high price because it is a seasonal flower and blooms only in summers. But with hydroponic technique; the cut flower growers can grow it well in regions having unfavourable climate. The advantage of growing tulips in a hydroponic farm is that it requires less space and grows quicker.

Benefits:

- Farmers don't need the soil to grow the crops; hydroponic farms are feasible in areas that are usually not suitable for traditional farming (arid, eroded, diseased, infertile)
- Ability to grow crops year-round; there are no seasonal limits
- Crops can develop faster
- Improved crop nutrition; crops don't waste energy trying to find the nutrients in the soil
- Water efficiency; hydroponic farming uses less water than soil-based farming; excessive water is collected and pumped right back to the plants
- Nutrients don't leach away
- There is no competition with weeds
- Soil-borne diseases are eliminated
- The practice is less-labor intensive
- It's possible to grow in a monoculture; a farmer can be focused on market demands instead of crop rotation practices
- Reduced transportation; crop production can be closer to the consumers
- At Vertical Roots, our systems use up to 98 percent less water than traditional soil-based systems.

- Other "resources" indoor hydroponic plants don't need? Pesticides and other potentially harmful chemicals, since the hydro crops are protected from many of the pests and plant diseases found outdoors in soil-based farms.

Disadvantages of Hydroponic Farming

Hydroponic crop production can be a challenging practice for some farmers, particularly because it demands knowledge of crop nutrient interaction, as well as an understanding of the hydroponic system. Since it's extremely important for the farmer to immediately respond to any changes in nutrient concentration, hydroponic crop production requires regular monitoring. Furthermore, hydroponic farming also requires high set-up costs. Finally, hydroponic farms are very vulnerable to power failures and water-borne diseases.

Conclusion:

Considering all of the aforementioned benefits, hydroponic farming is a practice that has the potential to eliminate many of the limitations seen in traditional crop production. Therefore, it could serve to be a turning point in feeding the global population. Farming year-round, without having to account for soil fertility, drought, weeds, crop rotation, and soil preparation practices, is a practice that sounds almost too good to be true. However, it is possible and really quite simple. Now days, growers with learned skill sets which is required for a successful hydroponic harvesting, making it possible to grow almost all kinds of vegetables. There are numerous success stories of farmers growing their crops hydroponically. Hydroponic crop production is more profitable than conventional farming because of advantages like pesticide-free production, soil-less growing condition, minimal or no pest entry, efficient use of resources and controlled environment. Market research shows that the global hydroponic market will grow at a compound annual growth rate of 22.5% between 2019 to 2025 due to the increasing demand for hygienic and hydroponically grown fruits and vegetables.

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