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CONTENTS

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MEYNA LAXIFLORA ROBYNS A POTENTIAL MULTIPURPOSE TREE: AN UNDERUTILIZED FRUIT AND MEDICINAL TREE IN MEGHALAYA

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ABSTRACT

Samatan (*Meyna laxiflora* Robyns) is an underutilized fruit and medicinal plant commonly found in natural forests and roadside in Meghalaya. The trees' habitats are the natural, evergreen and dry forests of the tropical and subtropical regions. There are 11 species of the genus *Meyna*, out M. maxiflora and M. spinosa, known to exist in the region. The two species are closely related and can be differentiated only through flower characteristics. The leaf is simple, elliptic-lanceolate in shape and glabrous on both surfaces, whereas flowers are greenish white, borne in leaf axillary, peduncled cymes arise on fascicled of leafless. Fruits are fleshy dupes, smooth globose with 4-5 one-seeded pyrenes, oblong-reniform shape, green colour at maturity and yellow-brownish at ripening. The flower appears during the month of February-March. Fruit set occurs during March-April and attain maturity and ripening during May-July. In addition to fresh consumption of fruits. In Meghalaya, the fruit is used for the preparation of wine which possesses unique flavours. However, the density of this species in Meghalaya is very low (3.7-13 per hectare). Therefore, the production technology and conservation measures of these underutilized fruits and medicinal plants must be undertaken.

INTRODUCTION

Samatan (*Meyna laxiflora* Robyns) is an underutilized fruit and medicinal plant commonly found in natural forests and roadside in Meghalaya. The trees' habitats are the natural, evergreen and dry forests of the tropical and subtropical regions. *Meyna laxiflora* Robyns is an essential minor fruit and the medicinal tree of the family Rubiaceae. The plant is reported to be native to western and northeastern India to Bangladesh (Anonymous, 2022).

NOMENCLATURE

The vernacular name of the plant varies with dialects.

Sl.No.	Vernacular name	Language/ dialects
1	Soh mon	Khasi
2	Samatan	Pnar
3	Thitchkeong	Garo
4	Kutkura, moin	Assamese
5	Heibi	Manipuri
6	Chegu gedde	Kannada
7	Chega, manga, veliki, vichikilamu	Telugu
8	Alu, Atu	Gujarati
9	Monono, Montaphoo	Uriya
10	Helu	Marathi
11	Main	Urdu
12	Bahu-vij, dal-amal, main and mayan	Hindi
13	Nagakesarah, phenil, pichuk, pindi-tak, taskar, shalya, vrishchika	Sanskrit

Source: Wikimedia Commons (2022).

HABITAT AND DISTRIBUTION

The trees are found to grow wild in the natural, evergreen and dry forests of the tropical and subtropical regions. It is distributed in northeast India, the Deccan peninsula, Konkan region, including Madh Hill of North Mumbai, North Bengal and Western Uttar Pradesh. In Khasi and Jaintia Hills, the density of *M. laxiflora* ranged from 3.7 to 13 per hectare (Suchiang et al., 2020).

GENETIC RELATIONSHIP

Earlier, *Vangueria spinosa* Fl. Br. Ind. covers a group of plants and is synonymy with *Pyrostria spinosa* (Roxb. ex Link) Miq.. However, recently the species have been classified into eleven different species of Meyna with the help of molecular phylogenetics (Anonymous, 2007.). *Meyna laxiflora* Robyns and *Meyna spinosa* Roxb.ex Link is the two species known to be found growing in India. The two species are closely related and have differences only in flowers. Flowers of *M. spinosa* Roxb.ex Link have flowers crowded into fascicles with shorter pedicels and petioles than that of *Meyna laxiflora* Robyns (Anonymous, 2007).

BOTANICAL DESCRIPTION

The plant is a large shrub while attaining tree characteristics at a lateral stage.

TREE CHARACTERISTICS

The trunk and branches of the trees are with opposite, straight (sometime 3 – nate) sharp spine (1.3-4 cm length). The bark is brown to deep grey (Plate 1a-b). The tree height is 2.5-7 m. Leaf is simple, opposite or 3-nately whorled (Plate 1c). Leaf shape is elliptic-lanceolate, acuminate at apex, cuneate at base, and glabrous on both surfaces. The leaf sizes are 2-7 cm in width and 4-13 cm in length. The leaf petiole is 1-1.6 cm long. Leaf stipules are triangular with 2-4 mm broad and 3-5 mm long acumen.

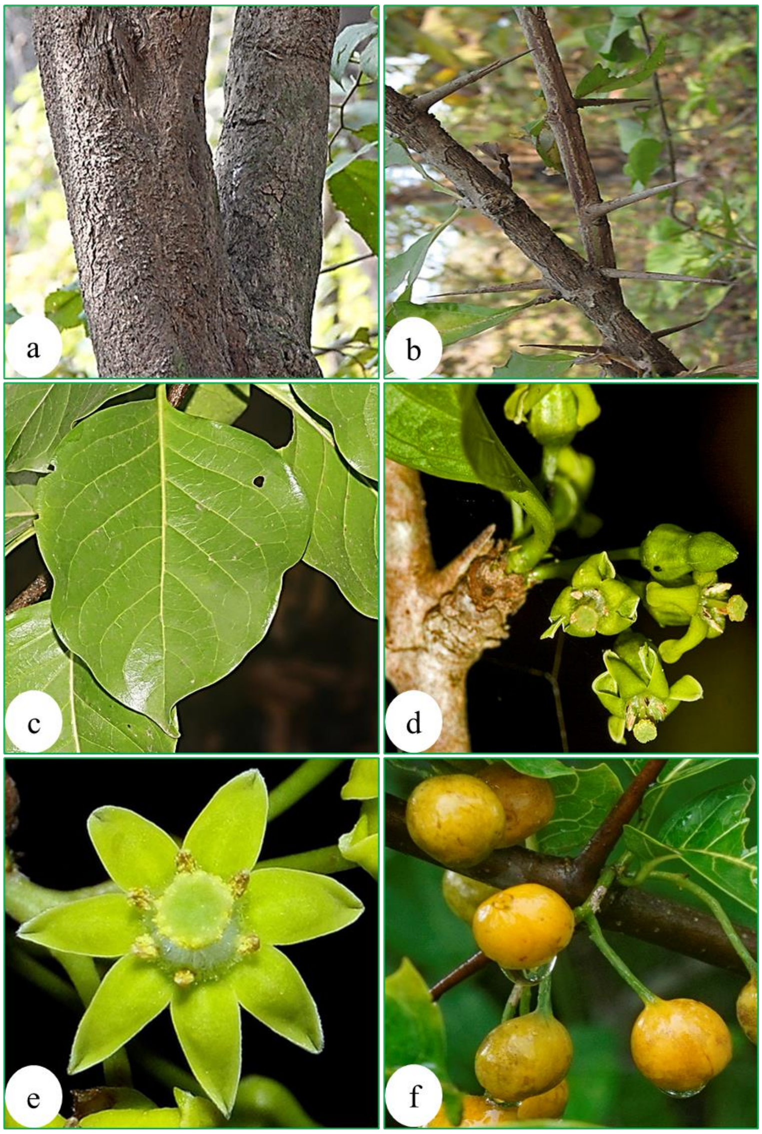

Plate 1: Photograph of different parts of *Meyna maxiflora* Robyns. a – stem and bark, b – spines, c – leaf, d – bearing habit, e – flower, f – fruits.

FLOWER CHARACTERISTICS

Flowers are greenish-white, borne in leaf axillary, peduncled cymes arise from the old scars below the leaves or fascicled on leafless wood (Plate 1d-e). Flower pedicels are 2-3 cm long. The calyx is glabrous, tube 2-3 mm long, cupular with 5 lobes, minute and triangular. Corolla is a tube with 3-4 mm long, broad, throat hairy with 5 lobes (sometime maybe 6-7 lobes), equalling the tube, ovate and acute. Stamens are 5, inserted on the throat of the corolla tube. Filaments are short. Anthers is 1 mm or little longer. Ovary is 5-

locular, with solitary pendulous ovule in each locule. The flower appears during the month of February-March.

FRUIT CHARACTERISTICS

Fruits are fleshy dupes, smooth globose with 4-5 one-seeded pyrenes, oblong-reniform shape, green colour at maturity and yellow-brownish at ripening (Plate 1f). The fruits are edible at ripening. Fruit size is 3-7 cm diameter. Fruiting pedicel is 1.6-2 cm long. Seeds are albuminous with a membranous testa. Fruit set occurs during March-April, and attain maturity and ripening during May-July.

UTILIZATION

The plant, including fruits, leaves, and bark, possesses ethnomedicinal use, as indicated in table 1. The preparation of jam from this fruit has been successfully standardized by Dhodade et al. (2019). Among the tribes of Khasi and Jaintia, fresh ripened fruits are eaten as a dessert. The ripened fruits are also used for wine preparation. The wine prepared from this fruit showed unique colour and aroma.

Table 1. Various traditional uses of *M. laxiflora*

Location/ Tribes	Treatment	Parts	Methods	References
The Chothe Tribe in the Bishnupur and Chandel districts of Manipur	Blood purification and skin texture	Fresh leaves	Use of fresh leaves as chutney	Purbashree Snglakpam et al., (2012); Yuhlung and Bhattacharyya (2014).
The Chothe Tribe in the Bishnupur and Chandel districts of Manipur	Curing constipation	Fruits	Use of fruits	Purbashree Snglakpam et al., (2012); Yuhlung and Bhattacharyya (2014).
Tribal community of Western Ghat region, Maharashtra	Narcotic and anti-dysentery	Young fruits	Use of young fruits and dried fruits as food	Deshmukh and Waghmode (2011)
Golghat, Assam	Abortifacient	Fruits	Use of fruits	Barikial and Sarma (2011)
Tinsukia, Assam	Abortifacient	Seeds	Seed paste with water through oral intake	Buragohain (2008)

Polia tribes, West Bengal	Abortifacient	Seeds and pulp	Preparation of pills made of a paste of riped fruits (seeds and pulp) mixed with 2-3 gloves of *Allium sativum* and 2.5 g of *Ferula asafoetida*). The pills were kept inside overnight to induce abortion up to 2 months of pregnancy	Mitra and Mukherjee (2009)
Meitei, Manipur	Hair	Leaves	Use leaves as an ingredient for the preparation of Chinghian herbal shampoo	Singh et al. (2014a)
Nashik, Maharashtra	Kidney stone	Seeds	Mix 5 pinches of seed powder with water and given twice a day for 15 days	Patil and Patil (2005)
Lakhimpur, Assam	Diptheria	Leaves	Use powdered leaves	Kirtikar and Basu (1975)
Lakhimpur, Assam	Snake-bite & scorpio-sting	Stem	Apply stem in combination with other drugs	Kirtikar and Basu (1975)
Meitei and Meitei-pangal, Manipur	Diabetes	Fruits	Use boiled extract of fruits	Khan and Yadava (2019)
Tribes of Tripura	Skin irritation	Tender leaves	Crush tender leaves (40-50 g) with little quantity of ginger or turmeric. Rub the paste on the infected area of the skin	Sen et al. (2011); Das et al. (2009)
Tribes of Nashik district	goitre or swellings	Leaves	Smear of fresh leaves with coconut oil by slight heating	Patil (2001)
Assam	Cure pimples	Seeds	Seed paste is applied to the skin	Buragohain and Konwar (2007)

CONCLUSION

Meyna laxiflora Robyns is underutilized fruit and medicinal species with little work that has been done on this crop. However, the uniqueness of wine flavours developed from this species may create an opportunity for its utilization in the beverage and pharmaceutical industries.

REFERENCES

Anonymous. 2007. The Wealth of India: A Dictionary of Raw Materials and Industrial Products, Raw Materials. 1st Supplement Series. Vol. 6. New Delhi: CSIR; 2007.

Anonymous. 2022. *Meyna laxiflora* Robyns. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:756200-1. (Accessed on 30.03.2022)

Barikial, J., Sarma, J. N. 2011. Ethnomedicinal plant used by peoples of Golghat district Assam India. *International Journal of Medicinal and Aromatic Plant*, 1(3): 203-211.

Buragohain, J. and Konwar, B.K. 2007. Ethnomedicinal plants used in skin diseases by some Indo-Mongoloid communities of Assam. *Asian Journal of Experimental Sciences*, 21:281-8.

Buragohain, J. 2008. Folk medicinal plants used in gynecological disorders in Tinsukia district, Assam, India. *Fitoterapia*, 79:388-92.

Das, H.B., Majumdar, K., Datta, B.K. and Ray, D. 2009. Ethanbotanical uses of some plants by Tripuri and Reang tribes of Tripura. *Natural Product Radiance*, 8:172-80.

Deshmukh, B.S. and Waghmode, A. 2011. Role of wild edible fruits as a food resource: Traditional knowledge. *International Journal of Pharmacy & Life Sciences*, 2(7): 919-924.

Dhodade, P.N., Dhaygude, Y.P., Tiwari, A.K. and Birwatkar, V.R. 2019. Development of Jam from Under Exploited Fruit Aliv (*Meyna laxiflora* Robyns). *International Journal of Current Microbiology and Applied Sciences*, *8*(3): 1143-1152

Khan, M.D. and Yadava, P.S. 2010. Antidiabetic plants used in Thoubal district of Manipur, Northeast India. *Indian Journal of Traditional Knowledge*, 9:510-4.

Kirtikar, K.R. and Basu, B.D. (1975). Indian Medicinal Plants, II, 1285, Delhi.

Mitra, S. and Mukherjee, S.K. 2009. Some abortifacient plants used by the tribal people of West Bangal. *Natural Product Radiance*, 8:167-71

Patil, M.V. 2001. Folk medicine of Nasik district (Maharashtra). *Ancient Science of Life*, 20(1): 1-5.

Patil, M.V. and Patil, D.A. 2005. Ethnomedicinal practices of Nashik district, Maharashtra. *Indian Journal of Traditional Knowledge*, 4(3): 287-290.

Purbashree, S., Mathur, R.R. and Pandey, A.K. 2012. Ethnobotany of Chothe tribes of Bishnupur district (Manipur). *Indian Journal of Natural Product Resources*, 3(3): 414-425.

Sen, S., Chakraborty, R., De, B. and Devanna, N. 2011. An ethnobotanical survey of medicinal plants used by ethnic people in West and South district of Tripura. *Indian Journal of Forestry Research*, 22:417-26.

Singh, S.R., Phurailatpam, A.K. and Senjam, P. 2014. Identification of the plants use as natural herbal shampoo in Manipur. *African Journal of Traditional Complementary Alternative Medicine*, 11(1): 135-139.

Suchiang, B.R., Nonghuloo, I.M., Kharbhih, S., Singh, P.P., Tiwary, R., Adhikari, D., Upadhaya, K., Ramanujam, P. and Barik, S.K. 2020. Tree diversity and community composition in sacred forests are superior than the other community forests in a human-dominated landscape of Meghalaya. *Tropical Ecology* **61:** 84–105. https://doi.org/10.1007/s42965-020-00066-w

Wikimedia Commons. 2022. *https://commons.wikimedia.org/wiki/File:Meyna_laxiflora_(6903947766).jpg* (Accessed on 30.03.2022)

Yuhlung, C.C. and Bhattacharyya, M. 2014. Practice of ethno-medicine among the Chothe tribe of Manipur, North East India, *International Journal of Pharmaceutical & Biological Archives*, 5(3): 138–149.

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DRONE TECHNOLOGY- A NEW STEP IN AGRICULTURE

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ABSTRACT

Drones are the futuristic technology of farming to drive the agriculture sector to new heights by monitoring crop growth by assessing and mapping technologies. Drones can transform traditional farming into smart farming. The activities carried out by the drone are precise, optimum and target-oriented in nature. With the help of multiple sensors, photo cameras, and programmable software available in drones, it is easy to manage farms, save resources, and get more return on investment. Drones help carry out timely farm operations and make farming better to manage. Nowadays, the government also provides a considerable amount of subsides to purchase drones to increase the income level of the farming community. The benefits of drone technology make it a new step in agriculture for achieving better productivity and profitability for the farming community.

INTRODUCTION

Drones are unmanned aerial vehicles (UAVs) or remotely piloted aerial systems (RPAS) controlled either by a pilot on the ground or with the help of technologies. The drones are working with the help of navigation systems, GPS, multiple sensors, high-resolution cameras, programmable controllers and other tools of autonomous technologies. The working principle of a drone includes four major steps that are 1. analyzing the area, 2. uploading the data to software for further analysis, 3: data processing, 4. Data output for getting a replica of the area in a precise image manner. Drones generally collect raw data of the location and translate it into the algorithm for creating prescription maps for various applications in respective fields.

DRONE TECHNOLOGY IN AGRICULTURE, WHY?

Earlier drones were only limited to the military, but their uses are increasing in precision agriculture. The productivity and efficiency of the Indian agriculture sector are not up to the mark of the country's potential status due to unsuitable crop monitoring methods, unprecise irrigation methods, faulty use of chemicals, and inadequate resource management activities. The purpose of adopting drone technology in agriculture is to get accurate and reliable information on external factors like weather, soil conditions and temperature, which play a crucial role in present-day farming. The adoption of drone technology in agriculture empowers the farmers to adopt smart agriculture practices to make mindful choices accordingly. Precise application of technologies with the help of drone survey helps maximize crop yields and return on investment (ROI) and minimize the time, resources and expenses in farming.

DRONE TECHNOLOGY USES IN AGRICULTURE

Technology adoption is the key to achieving the productivity of existing cropping systems. Drone technology is one of the novel technology applications in farming. Drones are presently used in the below areas of agriculture to increase efficiency and save resources.

SOIL ANALYSIS: To prepare precise 3D maps based on multispectral remote sensing of soil moisture content, physical soil conditions and soil topography level.

CROP ASSESSMENT: Crop assessment or monitoring is the biggest headache on large farms. For easier crop health assessment, crop damage identification is possible based on NDVI difference values, different reflection amounts of green light, and near-infrared spectroscopy (NIRS) light monitoring.

SPRAYING: With the help of RGB (red, green, blue) sensors and optical fibre sensors, problematic areas can be identified and treated.

PLANTING: By topography and algorithm images of the area with the help of electronic speed controllers (ESC) and micro-controllers attached to brushless DC motors (BLDC) of UAV machine, planting of shoot pods, seeds and nutrients can be carried out.

LIVESTOCK TRACKING: The livestock 3D visualization with the help of the YOLO (you only look once) model and R-CNN algorithms accurate livestock monitor is carried out.

BENEFITS OF DRONE TECHNOLOGY IN AGRICULTURE

- **ENHANCED PRODUCTION**: drones help achieve more output per unit area by combing comprehensive irrigation management, crop health assessment, soil health care, and adoption to changing environment.
- **MORE SAFETY FOR FARMERS**: the drone is the best choice to apply chemicals in challenging areas like terrains, taller plants, infected areas, etc.
- **FASTER ASSESSMENT**: surveying area to create maps, crop quality assessment, and crop damage analysis to claim crop insurance assessment is faster.
- **HIGH EFFICIENCY**: there is no delay in operations and completes the activities in a short period.

- **Large-scale farm maintenance:** With the help of sensor technologies available in drones, it is easy to maintain and carry out operations on a large scale.
- **MORE VERSATILE AND COST-EFFECTIVE**: They provide more accurate and cost-effective data than satellite images.
- **HELPS IN ENVIRONMENTAL DATA MONITORING**: Monitored data is used for smart climate agriculture as a pathway for sustainable farming.
- **REDUCING FARM OPERATIONAL COST**: Labour cost can be saved in spraying work, thereby; reducing the cost of cultivation.

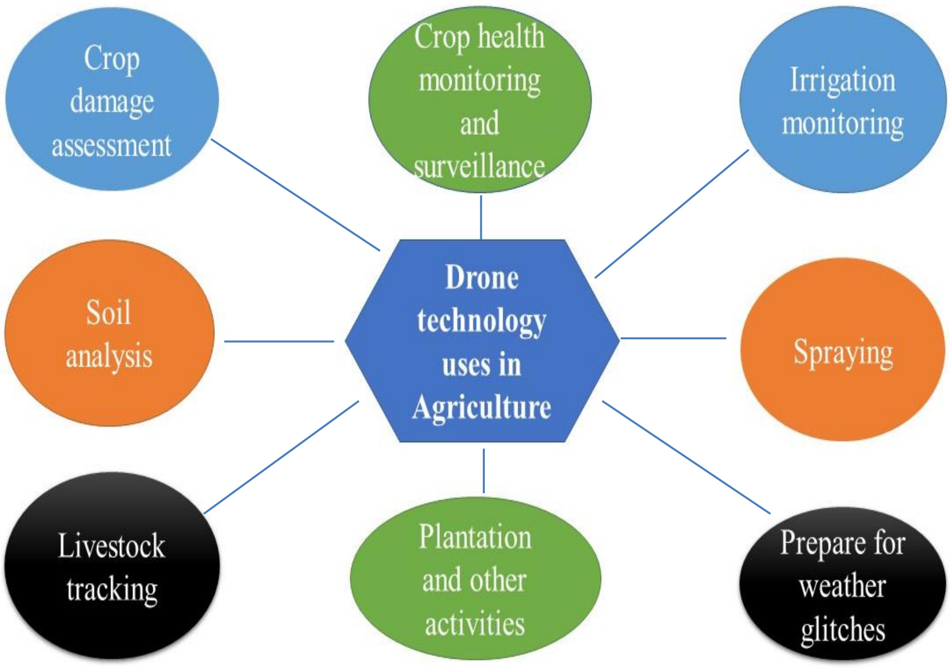

Fig.1 Uses of drone technology in agriculture

LIMITATIONS OF DRONE TECHNOLOGY IN AGRICULTURE

- **WEATHER DEPENDENT**: not advisable to fly drones under rainy or windy conditions. Windy weather leads to mismatching the spraying pattern of drones.
- **SPECIAL KNOWLEDGE AND SKILL**: require special knowledge and skills to operate and understand drones for agriculture purposes.
- **NOT HELPFUL FOR SPECIFIC CROPS AND PROBLEMS**: Specific mimicry behaviour of weeds, plants, insects and diseases leads to faulty analysis.

- **FLIGHT TIME AND RANGE**: carrying out larger area operations is difficult to manage due to flight time, which is limited to 20-60 minutes in the majority of drones and short-range flying.
- **HIGH INITIAL COST**: Agricultural drones used for surveying and spraying may cost up to $25000 (precision hawk Lancaster type) based on features and sensors.

SCHEMES AVAILABLE FOR DRONE TECHNOLOGY IN AGRICULTURE:

SUB-MISSION ON AGRICULTURAL MECHANISATION (SMAM) SCHEME-2022:

- The SMAM scheme grants up to 100% or ten lakhs as a grant fund for purchasing drones by ICAR institutes, KVK and SAUs. It also provides 75% grant funds for drone purchases to farmer producer organizations (FPOs).
- 50% or up to 5 lakhs of a grant fund for drone purchase to agriculture graduates establishing custom hiring centres (CHCs)
- 40% or 4 lakh grants to existing CHCs, FPOs and rural entrepreneurs.

KISAN DRONE SCHEME-2022:

- Kisan drone yatra or Kisan drone suvidha scheme has flagged 100 drone start-ups to develop drones for transport fruits, vegetables and other commodities to market directly from farm.
- It also includes crop surveying assessment, digitalization of land records, and spraying chemicals and nutrients to crops.

CONCLUSION

Undoubtfully, drones are the future of Indian farming community to transform traditional farming into smart farming. The activities carried out by the drone are precise, optimum and target-oriented in nature. With the help of multiple sensors, photo cameras, and programmable software available in drones, it is easy to manage farms, save resources, and get more return on investment. Drones help carry out timely farm operations and make farming better to manage. Nowadays, the government also provides a considerable amount of subsides to purchase drones to increase the income level of the farming community.

REFERENCES

Ahirwar, S., R. Swarnkar, S. Bhukya and Namwade, G. 2019. Application of Drone in Agriculture.Int.J.Curr.Microbiol.App.Sci.8(01):2500-2505.Doi: https://doi.org/10.20546/ijcmas.2019.801.264.

https://grinddrone.com/info/pros-and-cons-in-agriculture.

https://timesofindia.indiatimes.com/business/india-business/farming-going-hi-tech-govt-to-fund-drone-use-in-agriculture/articleshow/89024930.cms.

https://timesofindia.indiatimes.com/india/pm-modi-launches-kisan-drone-yatra-assures-full-govt-support-to-startups/articleshow/89678167.cms.

https://www.ihci-conf.org/wp-content/uploads/2021/07/05_202107C015_Yang.pdf

Pathak H, Kumar GAK, Mohapatra SD, Gaikwad BB and Rane J, (2020), Use of Drones in Agriculture: Potentials, Problems and Policy Needs, Publication no. 300, ICAR-NIASM, pp 13+iv.

Standard operating procedure (SOP) for use of Drone application in Agriculture.2022. GOI. New Delhi.

Sylvester, G. 2018.E- agriculture in action: drones for agriculture. FAO and ITU Bangkok.

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RAIN PORT IRRIGATION – A REPLACEMNET TO SPRINKLER IRRIGATION

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ABSTRACT

Micro-irrigation techniques trekking towards the doubling the farm income by increasing the productivity, viz., doubling farmers' income and increased water use efficiency in bi-directional mode as resource enhancement on one side and judicious use of resources on the other side. The rain port irrigation systems have the edge cutting advantage over the existing micro irrigation systems in terms of cost, ease of operation, water use efficiency etc. Further, it can be adopted for a wide range of the crops like other micro-irrigation systems. This type of system has an advantage over the other micro-irrigation system in increasing the harvestable basket, water use efficiency, and water conservation.

INTRODUCTION

Irrigation was done through flooding from 1950 to 2000, later on, moved to micro irrigations such as drip and sprinkler and ruled over two decades viz., 2006- 2020. Now irrigation concept has become more précised with advanced irrigation methods such as rain port irrigation, laser irrigation, etc. (Reddy *et al.*, 2021). Precision farming practices and plasticulture technologies such as micro-irrigation techniques have proved to be a driving force for enhancing farmers' income through increased productivity and optimum utilization of various inputs. Micro-irrigation technologies (MI) are being expanded horizontally in vast stretches across the length and breadth of the country, covering 3.56 million ha area under micro-irrigation in the sampled 13 states. (Chandra shekeran and Suresh, 2012). The micro-irrigation techniques expanded vertically from orchards to ornamental crops too. These technologies are promoted primarily as (1) a means to save water in irrigated agriculture, (2) a strategy to increase income and reduce poverty, and (3) to enhance the food and nutritional security of rural households. Despite the reported significant economic advantages and the concerted support of the government and NGOs, the current area under micro-irrigation is trekking on a large scale; still, the water use efficiency has not improved much across the country. There is a dire need to develop an advanced micro-irrigation system with higher water use efficiency. Rain port irrigation system is an innovative and advanced version of sprinkler irrigation with improved water use efficiency.

RAIN PORT IRRIGATION SYSTEM

A rain port system is an advanced version of a sprinkler irrigation system with a discharge rate of 800 litres per hour and 90-95 % uniform made with PVC/ HDPE at a low cost. Rain port sprinkler systems are mini-irrigation systems, i.e., laterals and sprinklers can be easily shifted from one place to another. Reinstallation of the system is also easy and consumes less time and labour. The approximate cost for a one-hectare installation is around 45000 INR.

Fig. 1 Rain port irrigation system field view

In the rain port irrigation system, flexible polyethene tubes are used as lateral and high-performance low; weight plastic sprinklers are connected to these tubes using easily detachable connectors. Sprinklers are fixed on MS riser rods.

a) The rain port system was made with Linear, Low-Density Polyethene materials and is easily flexible and suitable for transport and layout.
b) The operating pressure required for the rain port system- is 1.5 kg cm^{-2}

Saddle

Flash cap

HDPE 32 mm lateral

Raiser rod with rain port assembly

Fig. 2 The different components of rain port system

c) Throwing radius of each rain port sprinkler - 10 m (operates at 1.5 kg cm^{-2})

d) Distance between each rain port sprinkler for the effective uniformity- 8m x 8m

e) Each rain port sprinkler covers around 64 m^2 of area. For 1 acre with the rain port system with 8m X 8m spacing, it requires 63 rain port sprinklers

f) The discharge of each rain port sprinkler is around 540 l hr^{-1}

g) The depth of irrigation achieved with one rain port sprinkler is- 2.7 mm hr^{-1}

h) The available diameter size of the rain port sprinklers is - 25 mm and 32mm

i) The minimum and maximum operating pressure required for the rain port irrigation system is 2 to 4 kg cm^{-2}.

Table 1: Difference between the rain port and sprinkler irrigation system

Parameter	Rain port irrigation	Sprinkler irrigation
Spacing between laterals	9 x 9 m	12 x 12 m
Discharge (l hr^{-1})	540	1500
Pressure (kg cm^{-2})	1.5	1.5-2
Depth of Application (mm hr^{-1})	8	10
Cost per acre (INR $acre^{-1}$) approx.	20000	25000
Radius of operation	10 m	10-12m

Compared to the sprinkler system (10 m), the throwing radius is slightly lower, i.e., 9m in the rain port system. The discharge rate of each rain port came down to 1/3 of the sprinkler discharge to increase the water use efficiency and operate even under low water availability. The operational pressure for the rain port system is 1.5 kg $cm^{-2,}$ which is 0.5 kg cm^{-2} lower than the normal rain port sprinkler system. Though the discharge is lower than the sprinkler irrigation system rain port irrigation system, the depth of application is 8 mm per hour compared to sprinkler, i.e., 10 mm per hour. The distance between the lateral is 9 meters in the rain port system, whereas, in the sprinkler irrigation system, the spacing between the lateral is 10 m.

SUITABILITY OF CROPS

Rain port irrigation systems can be suitable for a wide range of crops, including groundnut and green forage crops.

CONCLUSION

The rain port irrigation system has the advantage over the sprinkler system with ease of operation, shifting of fields, higher water use efficiency with lower discharge rates and lower the cost is the best system to be promoted in future.

REFERENCES

Chandrasekaran, M and D. Suresh Kumar. 2012. Micro Irrigation: Economics and Outreach in Tamil Nadu.

Pavan Kumar Reddy, Y., Sahadeva Reddy, B., Siva Jyothi, V., Ashok Kumar, K., Malleswara Reddy, A. 2021. Irrigation Methods to Crops- Past, Present and Future. *Indian Farmer* 8(**03**): 247-252.

Rain port -Mini Sprinkler Irrigation System Manual of Jain Irrigation Systems Ltd, Jalgaon

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VOLUME 2 ISSUE 5 MAY, 2022

PESTICIDE SORPTION IN SOIL: MECHANISM AND FACTORS

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ABSTRACT

In last six decades the food production increased exponentially in the India from fifty million tonnes to two hundred eighty-four million tonnes. With increases in production the pesticides per capita consumption also increased from 0 to 0.6 kg ha^{-1}. The major dilemma in using pesticides occurs when they are applied to the crop immobilized through sorption via different methods. Soil organic matter (SOM) and clay minerals are the main reasons that sorption. Pesticide in the either remain in free or bound (adsorbed) form. The sorbed state of pesticides do not subjected to microbial degradation, while free form remains in drive along with water. This drive of pesticides in soil creates hindrance in control of the targeted pests and the contamination of environmental components. Pesticide sorption creates a greater threat of pesticide residue in food commodities and danger to health effects but knowing the sorption mechanism and other properties of pesticides and soil will help us minimize the side effect.

INTRODUCTION

In India for production of cotton, rice, grain, millets and oilseeds approximately eighty thousand tonnes of pesticides get consumed. The prominent states which use pesticides includes Haryana, Punjab and Uttar Pradesh that have the most considerable pesticide utilization, utilizing 45,000 tons of (specialized grade) pesticides in 2000–01. This improved utilization has prompted the exhaustion of soil fruitfulness and a decrease in manageable yield production.

In last six decades the food production increased exponentially in the India from fifty million tonnes to two hundred eighty-four million tonnes. In India, pests and diseases, on average, eat away around 20–25% of the total food produced. With increases in production the pesticides per capita consumption also increased from 0 to 0.6 kg ha^{-1}. In comparison to other countries, we are using a very less amount of pesticides. Pesticides are applied to crops immobilized through sorption via different methods and factors. (Tiryaki and Temur, 2010).

PESTICIDES APPLICATION IN SOIL

- **Deliberate application**
- **Accidental**
  - i. Spray drift
  - ii. Burial of container
  - iii. Equipment washing
  - iv. Washing from the plant surface
  - v. Pesticide vapours dissolved in rain
  - vi. Plant residue

Pesticides in soil occur in two forms:

1. Free

- i. Adsorption
- ii. Degradation
- iii. Transport :(Soil to air – Volatilization) (Soil to water – Runoff and leaching) (Soil to biota –Uptake) (Movement in soil –Diffusion and mass flow)

2. Bound

ADSORPTION

Adsorption can be described as surface phenomenon which divides of pesticide molecules in the solid form and liquid form. It decreases via volatility and plant uptake, microbial degradation, dispersion in groundwater and adsorption increases through transport by erosion/runoff.

PESTICIDE SORPTION

Active accumulation of pesticides needs some attraction between solute and sorbent. Soil colloids may have a partial or complete charge, which may be temporary or permanent. Similarly, pesticide molecules may be ionic or may dissociate in soil to give an ionic compound or have partial charges. The pesticides sorption may occurs either through physical adsorption by dipole-dipole interaction or through chemical adsorption by bond formation in adsorbent and adsorbate atom.

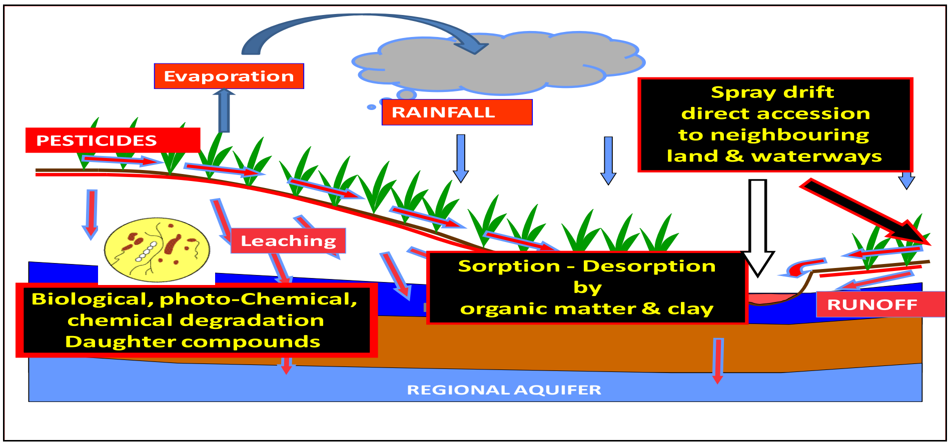

Fig.1 Pesticides in soil

MECHANISM INVOLVED IN PESTICIDE SORPTION

1. Van-der waal attraction
2. Hydrogen bonding
3. Hydrophobic bonding
4. Charge transfer
5. Ion exchange
6. Ligand exchange

FACTORS AFFECTING SORPTION

- **Properties of soil:** The different soil chemical properties which includes soil organic matter, clay content, soil moisture, soil reaction, soil temperature etc.
- **Properties of pesticide:** Properties of the pesticide such as acidity (pKa), basicity (pKb), solubility, charge distribution, the polarity of the molecule, molecular size and its concentration in the solvent.

PROPERTIES OF SOIL

1. SOIL ORGANIC MATTER:

- It contains polar groups like acid, amine, amide, phenol etc. It also has hydrophobic fractions like lipid. Thus, it can be the site for adsorption of ionic and non-ionic compounds as several sorption mechanisms are possible, thereby it play a significant role in sorption of pesticides.
- In general, the sorption of pesticides is directly proportional to the soil organic matter or organic carbon content. However, recent studies have shown that it is not the total organic carbon content but the chemical nature of the organic carbon which can significantly affect the pesticide adsorption.

2. CLAYS:

The clay fraction of soil, especially in soil having low organic carbon content, significantly affects pesticide adsorption. Three-layer minerals show higher adsorption potential than two-layer minerals.

3. **METAL OXIDES AND HYDROXIDES:**

They behave like clays and affect adsorption. Iron oxides in laterite soils greatly affect pesticide adsorption.

4. ***p*H:**

Soil pH greatly affects the active centers in soil. It also affects pesticide molecule ionization or polarization. Adsorption of triazine, amide, sulfonylureas, urea group of pesticide is pH dependent. Above the pH greater than pKa, the molecule exists as a negative ion while below pKa, it exists as a positive ion.

5. **TYPE OF EXCHANGE CATIONS:**

The type and nature of exchangeable metal cation on clay surface significantly controls the complex formation of the EDA (electron donor-acceptor). The high surface density of strongly hydrated cations (Na^+, Ca^{2+}, Al^{3+}) reduces the accessibility of siloxane sites for pesticides, while small and weakly hydrated cations (K^+ and NH_4^+) allow better EDA complex formation.

PROPERTIES OF PESTICIDES

1. Functional groups: Functional groups in pesticides like carbonyl, carboxylic, ester, amide, phenol etc., affect sorption as they can get ionized or polarized. Further, electro-negativity or electro-positivity of a group adjacent to a function can affect ionization and polarization.
2. The dissociation constant: Pesticide's dissociation constant (pka and pKb) affect their ionization. Pesticides which generate ions in the soil, depending on the pH, have different operative mechanisms. Cationic pesticides are more sorbed in soil.

MOVEMENT/TRANSPORT OF PESTICIDES

Pesticide in the soil is in a free and adsorbed form. The sorbed state of pesticides do not subjected to microbial degradation, while free form remains in drive along with water. This drive of pesticides in soil creates hindrance in control of the targeted pests and the contamination of environmental components.

CONCLUSION

Pesticides' status in the ecosystem is largely determined by how they behave in soils and their adsorption and microbial and abiotic breakdown. The amount of these processes is determined by pesticide Physico-chemical qualities and soil characteristics. Environmental factors such as relative humidity, temperature, and water content are also heavily influenced by environmental factors. To increase our understanding of pesticide fate in soils, we need to consider the heterogeneity and unpredictability of soils. In studies, major integrative dynamics significant to the topsoil structure and surface properties at different water contents must be considered. In ascending order, integrative limitations depend on the scale: Organic matter hydrophobic structures, wettability. Lastly, the wet and dry cycle effect on pesticides is not known or poorly known and must be studied in these vulnerable and critical climate change circumstances.

REFERENCE

Tiryaki, O. and Temur, C. 2010. The fate of pesticides in the environment. *Journal of Biological and Environmental Sciences* 4: 29–38.

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AGRONOMIC MEASURES: A WAY FORWARD TO TRANSFORM GREY LANDS INTO GREEN LANDS

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ABSTRACT

Dryland areas are a defining feature of our planet and cover 42.3 per cent of the earth's surface, which is inhabited by 2.3 billion people (about one-third of the world population) and also inhabit 50 per cent of the world's livestock population. Dryland agriculture limits crop growth to a part of the year due to insufficient moisture. The major limitations of dryland areas are climatic conditions and low soil fertility. The adoption of appropriate measures like the selection of early maturing short-duration crops and mixed/intercropping systems, contour farming, strip cropping, mulching, cover crops, crop rotation, and adopting in-situ moisture conservation practices along with the use of antitranspirants potentially reduce the soil and water loss through water and wind erosion. Enhancing water harvesting and providing life-saving irrigations at critical crop growth stages may help to improve the yield potential of dryland crops. By this, it is clear that adopting appropriate agronomic measures has full potential to reduce the considerable risk of crop failure and cost of cultivation without any crop yield sacrifice and ultimately restore the productivity and profitability of dryland areas on a sustainable basis.

INTRODUCTION

Dryland areas are a defining feature of our planet and cover 42.3 per cent of the earth's surface, which is inhabited by 2.3 billion people (about one-third of the world population) and also inhabit 50 per cent of the world's livestock population. Dryland agriculture limits crop growth to a part of the year due to insufficient moisture. Notably, 65 per cent of the cultivated area in Indian agriculture comes under drylands, contributing to around 44 per cent of total food production (fig. 1), thereby playing a critical role in the nation's food security. Geographically dryland areas in India include the north western desert regions of

Rajasthan, the plateau region of central India, the alluvial plains of the Ganga Yamuna River basin, the central highlands of Gujarat, Maharashtra, and Madhya Pradesh, the rain shadow regions of Deccan in Maharashtra, the Deccan Plateau of Andhra Pradesh and the Tamil Nadu highlands.

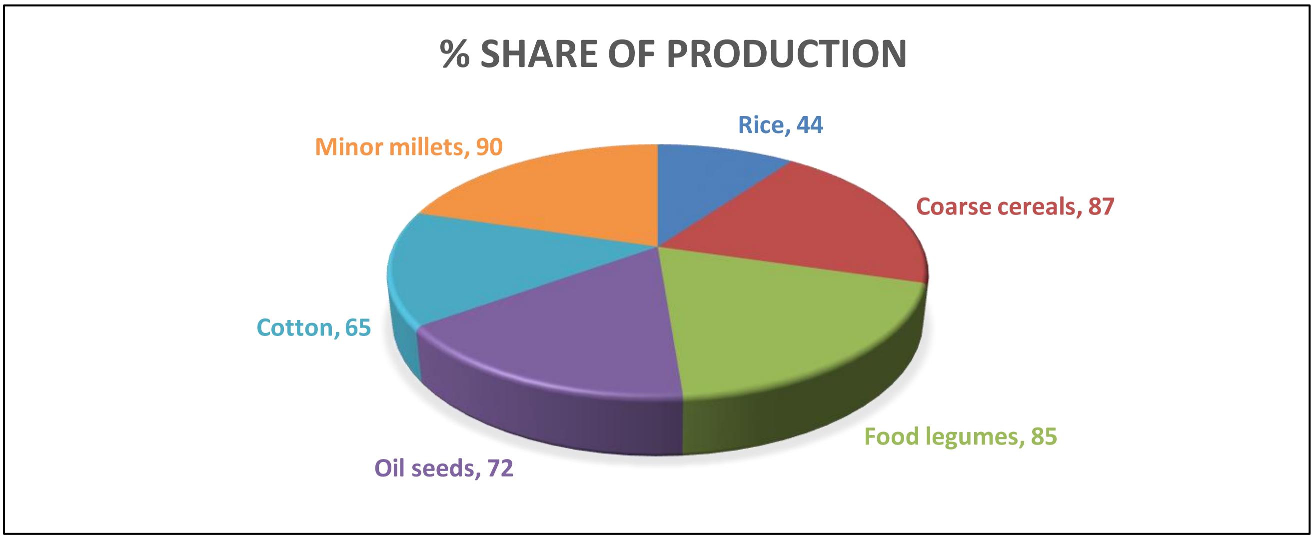

Fig 1. Per cent share of dryland crops in national food grain production

CONSTRAINTS FOR CROP PRODUCTION IN DRYLAND AREAS

Dryland areas are economically fragile regions highly vulnerable to environmental stress and shocks. These constraints in the dryland areas have been divided into two parts: Climatic constraints and soil constraints (fig. 2). Climatic constraints are highly variable rainfall, late onset of the monsoon, inequitable rainfall distribution, and early monsoon withdrawal. The four important soil constraints are soil erosion, low water retentivity, low soil fertility, and soil reaction. Due to soil degradation, the world is losing 5 to 7 Mha of arable land every year.

WHY FOCUSING ON DRYLAND AREAS IS IMPORTANT?

The scope to increase the area under ploughing is limited under irrigated conditions. The net sown area has shown a declined trend of 142 mha in 2019 to 139.4 mha in 2022. However, the human and livestock populations have been steadily increasing, resulting in increased food and feed demand. Productivity of grains already showed a plateau in irrigated agriculture. Several problems like nutrient exhaustion, salinity buildup in irrigated agriculture, and climate change make cultivation challenging.

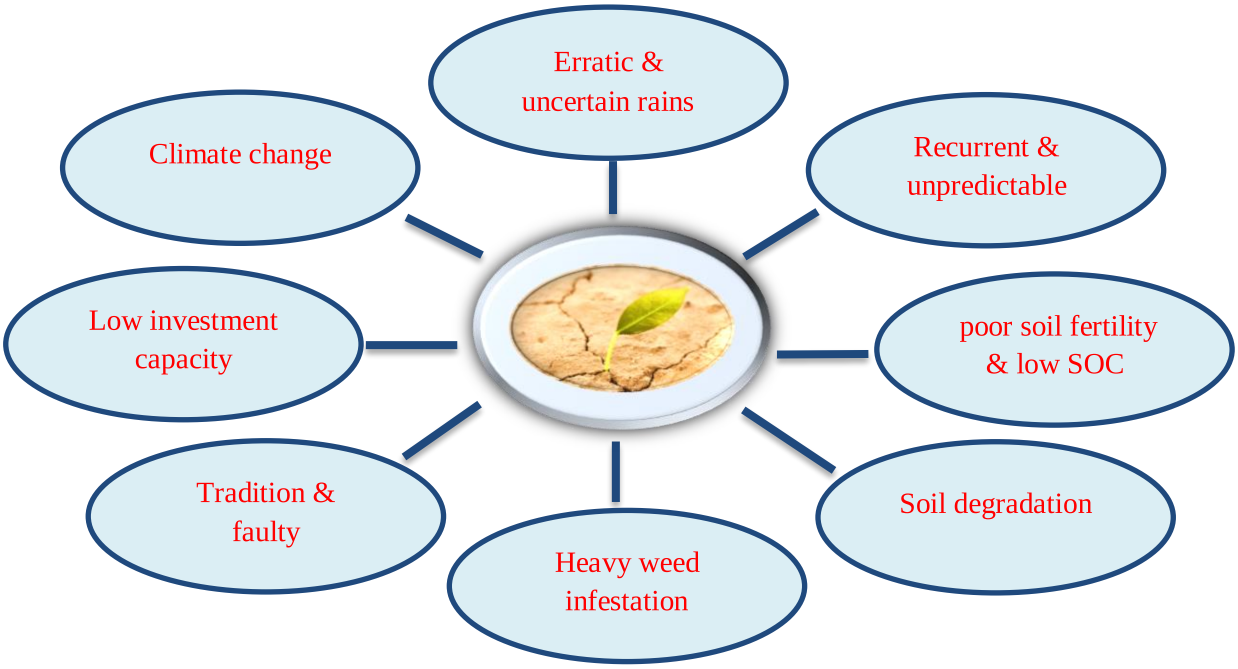

Fig. 2. Major constraints for crop production

Further increasing the production only be achieved by increasing dryland areas' productivity. Dryland farming will be the most crucial subject in the future to combat poverty and ensure food security. At present, crop productivity of 3 ha of dryland area is equivalent to the crop productivity from one ha of land in irrigated area. So, to enhance the production level, there is an immense need to focus on dryland farming.

AGRONOMIC MEASURES TO IMPROVE THE DRYLAND AREA PRODUCTIVITY

Agronomic measures are the practices that farmers incorporate to improve soil quality, enhance water usage, manage crops and improve the environment. Agronomy measures involve operations from sowing to final crop harvesting (fig. 3), so the adoption or manipulation of any operation in such a manner to promote soil and water quality highly helps to enhance the productive capacity of soil to produce more products from low investment and thereby the livelihood security of farmers.

Fig. 3 Various agronomic measures to make dryland areas into productive lands

TILLAGE: Tillage is the essential operation that takes maximum importance in crop production and highly influences the extent of soil and water erosion in dryland areas. Depth of tillage, time of tillage, the direction of tillage (across the slope), and tillage intensity are the significant factors that must be considered before carrying out any tillage operation. Adopting minimum / reduced tillage or conservation/mulch tillage greatly reduces erosion problems in Dryland areas.

CROP AND CROPPING SYSTEM: The poor or suboptimal crop stand is the primary reason for low crop yields in dryland areas. The selection of drought-tolerant crops and early maturing varieties is significantly helpful in overcoming moisture stress problems. Also, seed treatment and seed hardening help reduce seedling mortality at the early crop growth stages. Using the correct method for the crop establishment at the right time along with recommended spacing and depth is instrumental in overcoming crop failure problems. The farmers must go with a cropping system-based approach rather than monocropping, and it makes the maximum and sustainable use of resources and reduces the risk of crop failure.

INTEGRATED NUTRIENT MANAGEMENT (INM): INM refers to the integration and usage of traditional and modern means of nutrient management into an economically optimal and ecologically sound farming system that makes it possible to use the benefits from different sources of organic, inorganic, and biological components/substances in a judicious, efficient and integrated manner. It enhances the use efficiency of both macro and micronutrient inputs. Further, it controls nutrient cycling in the soil to synchronize the plant nutrient demand and its release into the environment, resulting in improved nutrient/resource use efficiency, higher net returns per rupee investment, and enhanced resistance to various biotic and abiotic stresses.

WEED MANAGEMENT: Weeds are significant biotic stress and compete mainly for moisture in dryland and transpire more water per unit of dry matter accumulation than crop plants. The removal of weeds helps the main crop obtain greater accessibility to soil moisture and plant nutrients for its growth. So, an optimum weeding schedule may play an important part in realizing the higher yields from the dryland area. With the appropriate size of blade harrows/cycle weeders, line sowing and mechanical weeding remove unwanted vegetation that competes with the main crop. The herbicide application is limited (water scarcity and lack of awareness) in dryland agriculture.

SOIL WATER CONSERVATION: The dryland areas are far more prone to erosion since they are devoid of vegetative cover. Water is the biggest eroding agent wind is the next most significant. Adopting various agronomic measures significantly reduces soil and water erosion problems and improves the crop-producing capacity of dryland areas on a sustainable basis (Table 1).

Table 1. Potential agronomic measures to conserve soil and water in dryland areas

Measure	Associated benefits
Contour farming	Reduces soil and water erosion and improves soil water status.
Strip cropping	Checks water runoff and improves infiltration time of rainwater
Cover or mulch crops	Reduces the direct impact of raindrops on soil aggregates, checks weed growth and improves soil organic carbon status, etc.
Anti-transpirants	Reduces plant water loss by transpiration and helps to maintain favourable plant water balance
Windbreaks and shelterbelts	Potentially reduces wind erosion in arid and semi-arid areas and alters microclimate favourable to crop growth
In situ moisture conservation	Reduces water and soil erosion and enhances the water conservation as and when received by rainfall

RAINWATER HARVESTING AND SUPPLEMENTAL IRRIGATION: During high intense rainfall periods, the excess runoff can be safely collected by using various water harvesting structures like micro catchments, inter-row water harvesting systems, and traditional water harvesting systems (Tanka, Nadi, and Khadin) in arid regions and dug wells, tanks and farm ponds in the semi-arid region highly helps to conserve rainwater. The water harvested like this can be used for supplemental or life-saving irrigation, especially during the lean period, to boost crop productivity, production, and profitability.

CONTINGENCY PLAN AND MID-TERM CORRECTIONS: Nearly 35% area received rains between 750mm to 1120 mm and experienced frequent dry spells and drought, making crop production a gamble in dryland areas. Thus, the development of proper crop protection measures like mid-season corrections (thinning, urea or water spraying, weeding, reducing inter and intra row spacing, etc.) against droughts is necessary to safeguard the crops from several extraneous conditions. Even still, the crop may fail under certain situations, so it is necessary to develop a contingency crop plan to overcome the risk of crop failure.

CONCLUSION

The drylands areas can play an important role in global food security. The major limitations of dryland areas are climatic conditions and low soil fertility. The adoption of appropriate measures like the selection of early maturing short-duration crops and mixed/intercropping systems, contour farming, strip cropping, mulching, cover crops, crop rotation, and adopting in-situ moisture conservation practices along with the use of antitranspirants potentially reduce the soil and water loss through water and wind erosion. Enhancing water harvesting and providing life-saving irrigations at critical crop growth stages may help to improve the yield potential of dryland crops. By this, it is clear that adopting appropriate agronomic measures has full potential to reduce the considerable risk of crop failure and cost of cultivation without any crop yield sacrifice and ultimately restore the productivity and profitability of dryland areas on a sustainable basis.

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