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Nutrient Management in Dryland Agriculture of Karnataka

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Abstract: ***One of the main challenges in dryland agriculture is improving its productivity that is sustainable as the livelihood of the small and marginal farmers are dependent on rainfed farming. Among many factors that affect the productivity of the rainfed farms, the foremost are retaining the moisture in soil and the management of nutrients. This article emphasizes the requirement of the dryland agricultural farmers to take up an integrated approach in nutrient management coupled with the soil and moisture conservation practices for the enhancement in agricultural production in dryland farming.***

Keywords: Dryland, Soil moisture, Organic matter, Biomass, conservation

1. Introduction

The livelihood of farmers, particularly the small and marginal by enlarge depends on the rainfed agriculture. The productivity of the rain - fed area is relatively low. According to the department of agriculture, government of Karnataka more than 75 percent of the cultivated area is still under rain - fed condition. The State is encountering drought conditions frequently. Karnataka is positioned second in having a large percentage of the area under rainfed condition in the country. The practices to improve the crop yield are more concentrated in the irrigated land than the dry rain dependent lands. Though major portion of the food grains and oil seeds in are grown under rainfed conditions The focus of research in area of agriculture remains in irrigated land or horticulture crops.

Data and the source of data

The data is based on discussions with farmer self - help groups. The officials of NGOs - AME (Agriculture Man Ecology) at various parts of Karnataka, farmers in Jayamangali sub watershed at Madhugiri of Sujala watershed project. Participating in workshops, farmer field schools (FFS) and participatory technology development (PTD) programs organized by AME. Discussion with the officials of the department of Agriculture. Secondary data from organizations - AME foundation, LEISA India

The department of agriculture through its various programs have been aiming to promote crops like jowar, ragi, maize, groundnut, sunflower, pulses, oilseeds and some horticulture crops. They are working toward harnessing the opportunities existing in dryland areas for improving rural livelihoods.

Ragi is largely grown in southern districts of Karnataka. Red gram is the major pulse crops grown in the Kharif season and Bengal gram is an important rabi crop grown predominantly in the northern districts of the state. Groundnut is an important crop of the State grown in many districts including central Karnataka. Sesamum and safflower are oilseed crop of the State grown in rainfed condition.

Some of the challenges faced by the dryland farmers in nutrient management.

Soil erosion is a serious problem in drylands. Some of the important types of soil erosion in Karnataka are sheet, rill and gully erosion. Slopy and undulated lands further increases the soil erosion and worsens the fertility of the soil. The soil loss not only drains the fertile topsoil, but also reduces the rooting depth and thereby affects moisture retaining capability of the soil and thereby reducing the crop yields. Low moisture retention capacity and low soil fertility along with erratic, inadequate and uneven distribution of rainfall are some of the major problems in rainfed farming resulting in the most important challenge of organic farming particularly in dryland farming is the availability of sufficient organic matter for application in the field. The retention of moisture is even more challenging in the dryland farming. It is also affected by the pattern of rainfall distribution within the year, soil characteristics, altitude, temperature and slope and more importantly the soil type, among other things are import factors affecting the dryland agriculture and adoption of organic farming by the rainfed agriculture farmers of Karnataka. High temperatures and low availability of moisture is detrimental to the microbiota and the biofertilizer application in such conditions would not yield evident results**.**

The available moisture should be utilized properly based on the soil type. Water obtained during the sparse and irregular rainfall has to be conserved so that it can be utilized during dry periods. Water conservation measures should be emphasized. Watershed based approach are found to be more productive in terms of water and soil conservation. Both on - farm and off - farm soil and moisture conservation measures have to be practiced along with the measures to produce biomass required for fertility improvement of the farm. Some of the agronomical practices also help in soil and moisture conservation apart from improving the soil fertility.

The conservation of healthy communities of soil biota and cautious use of specific soil organisms through biological soil management can be used to maintain and enhance soil fertility and ensure productive and sustainable agricultural systems.

Sustainable agriculture includes the successful management of agricultural resources to satisfy human needs while maintaining or enhancing environmental quality and conserving natural resources for future generations. The sustained use of land and water resources is dependent upon maintaining the health of the living biota that provide critical processes and ecosystem services. Soil organisms have been shown to be potentially useful indicators of soil health because they respond to soil management.

Maintaining the moisture content and organic matter in the soil of the dryland after the cropping season is one of the challenges. Without the moisture content and availability of organic matter the population of the soil biota gets reduced leading to poor soil fertility. The application of biofertilizers to improve the soil microorganisms in rainfed farms is also not very effective due to poor implementation of water conservation methods and low organic content in the soil.

Though positive results are seen in adoption of biofertilizers among farmers of irrigated lands, the response is very poor among the farmer of rainfed agriculture land holders. Various factors contribute to such a poor response.

Some of the important practices that dryland farmer has to adopt for improving the soil and moisture conservation and nutrient management for sustainable increase in crop yield are:

1) Bunding of the farmland: the farmer has to ensure proper height and width of the farm bund based on the slope to withstand the speed of run - off water and make sure that the fertile soil and the water from his land does not flow out.
2) Cultivation across the slope: to conserve the moisture and fertile topsoil, the agricultural practices like ploughing, sowing and inter - cultivation have to be carried out across the slope.
3) Broad ridge and furrow beds: making broad ridge and furrow and sowing on the ridges helps to conserve rainwater in the furrows and ensure proper drainage.
4) Appropriate watershed management measures have to be adopted for the off - farm soil and moisture conservation. On - farm and off - farm conservation measure are interdependent and therefore it is inevitable to address both.
5) Mulching: mulching of crops with the agriculture wastes not only helps to conserve the moisture but also eventually helps in improving the fertility and water holding capacity of the soil.
6) Application of organic manure is the key to improve the moisture retention capacity of the soil and improve the soil fertility. It has been established that 5 tonnes of farmyard manure would be required for one hectare of dryland farm. But due to advanced agricultural practices that involves mechanization of farming practices, the availability of required quantity of organic manure in most cases has not been possible. So there arises the need for alternative means of producing the organic manure and improving the quality of the available manure to reduce the required quantity.
   - Proper composting of the farmyard waste and the other available biomass enhances its nutrient content.
   - Vermicomposting is another such measure that improves the quality and nutrient content. The biomasses that are grown on bunds or barren land could also be used for composting and vermicomposting
7) Green manuring by ploughing the crop residues into the soil after the cropping season is one of the methods. The other methods can be growing Macrotyloma uniflorum (horse gram) or any such legume crops that require less moisture and has bacteria associated with its roots that has the ability to fix atmospheric nitrogen. These crops grow even if there is one or two days of rainfall after the cropping season. Such crops can be ploughed into the soil once they grow to a height of about one foot. Green manuring could be ensured by growing short period quickly growing plant species on the bunds or adjacent barren land. The biomass (leafy branches) could be collected, spread on the field in off season and ploughed into the soil later. Species like *Glyricidia sepium, Sesbenia* sps, and *Cassia semeia* are few such plants.
8) Some of the agronomical practices like intercropping or mixed cropping of the deep - rooted legume species with the shallow rooted cereal crops helps not only in reducing the soil erosion it also helps in nutrient management, since legume plants harbour rhizobium that have the ability to fix nitrogen and the leaves shed by these plants add to the organic matter.
9) Crop rotation of cereal crops with legume crops will help in the nutrient management to a certain extent. This practise apart from managing the disease and pest also helps in nutrient management.

2. Conclusion

Farmers should be made aware of the fact that the improvement and sustainable production in dryland is possible if there is a continuous maintenance of soil moisture and organic matter, both during the cropping season and off season. If the farm is not taken care during the offseason (which is a usual norm in the drylands) the microbiota will not survive leading to the low fertility of soil. The soil texture also degrades over a period of time and ultimately the farm turns out to be less productive. The farmers need to be trained about the methods and practices that could be adopted for the nutrient management of the dryland and enhancing the productivity of the farmland. The integrated approach of soil and moisture conservation measures along with the nutrient management measures is imperative both in cropping and off season.

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