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Monocropping

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Abstract

Monocropping or monoculture is a process to culture a single crop in a farm land. Monocropping is a process by which a clear assessment of interaction of crop on soil land can be observed.This paper deals with the various dynamics of monocropping

Keywords*:-Monocropping, monoculture, assessment, soil, farm land*

INTRODUCTION

Many farmers plant only a single crop in the same place year after year. This is what is known as themonoculture crops. Supporters claim it is a more profitable way to farm than switching crops around each year. When the farmer grows only one type of crop he can specialize in that crop and purchase only the aids and machinery needed to deal with that crop. However, those against monocropping claim that it is very much hard on the environment and actually much less profitable than organic means of farming.

Disadvantages of Monoculture

Farming planting the same crop in the same place each and every year zaps nutrients from the earth and leaves soil weak and unable to support the healthy plant growth. Because soil structure and quality is so poor, farmers are forced to use the chemical fertilizers to encourage plant growth and fruit production. These fertilizers, in turn, specifically disrupt the natural makeup of the soil and contribute further to the nutrient depletion. Monocropping also creates the spread of pests and diseases, which must be treated very well, with yet more chemicals. The effects of monocropping on the

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environment are chronic when pesticides and fertilizers make their way into ground water or become airborne, creating pollution.

Soil quality is essential for theplant and animal health, maintenance of the environment, and sustained biological productivity. Soil microbes play a key role in maintaining soil quality. Microbial diversity of the rhizosphere is believed to be beneficial for the soil health and the trophic interactions within the rhizosphere can affect the aboveground community of plants. Our understanding of the soil microbial functioning in this plant-microbe interaction has generally been limited(Green et al., 2005).

Plant variety has the significant influence on the associated soil microbial community, as measured bythe community-level physiological profiling (CLPP) by Dunfield and Germida. These authors also found thatthe seasonal differences in this community were not permanent (Tilman, 2001). Ecologist found that the rhizosphere microorganism's community was plant species-specific, whiletheEcologist stated that the root exudates from different plants and even different cultivars of the same plants differed and these caused differences in the rhizosphere communities allied with the plants. Thus, it could be expected that the microbial communities under wheat monoculture and wheat in the rotation with the legume pasture would differ significantly.

Various role players are more frequently requesting data on the impact of land use management practices on the physical, chemical, and thebiological fertility of soils. There exists little knowledge about how a management system influences the microbial communities and as a result the fertility of the soil .When thephysicochemical properties of a soil are altered by agricultural practices, the microbial community may respond to these transformations (Gibbs et al., 2010).

In recent years,the soil microbial diversity was estimated using molecular methods. However, it was found thatthe diversity indices based on DNA heterogeneity may be ambiguous especially when determined for the soils comprising a high diversity of microbes. Researchers concluded that molecular analysis and assessment of an environment often leads to a distorted view of the diversity of an ecosystem. The methods availed to extract DNA from the soil also affect the results of thediversity estimations. These methods are also costly

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and require a high level of expertise. Although only a very small fraction of soil microbes is culturable, some researchers found that the culturable microbial populations could act as indicators of the soil health. Ecologist found that the energy flow via the non-colony forming themicrobial population is a very small fraction of that of the whole of the soil ecosystem, while researchers found that monitoring colony forming bacteria was much useful tool in determining the effect of the anthropogenic actions. Researchers described culturable bacteria as being useful in indicating theselected agronomic disturbances as well as adding to our understanding of the link between microbes and environmental processes(Tscharntke et al., 2005).

There seems to be a very clear relationship between soil microbial diversity, soil, and plant quality, as well as the ecosystem sustainability and it is known that crop rotation benefits wheat yield. The question now arises: can agricultural management strategies and practices bring about changes in the soil's physicochemical and the biological properties—the ecosystem profile—of a wheat field? This study was conducted to assess and evaluate selected soil physicochemical properties and the microbial parameters under two different management systems, namely, wheat monoculture and wheat in rotation with annual legume pastures.

Retaining the natural habitat remnants within agricultural landscapes also reduces the land available forthe growing crops, and so may constitute an opportunity cost to local production as well as potentially aggrandizing the demand for converting land elsewhere to agriculture. Landscape-scale planning for the agricultural sustainability and conservation therefore hinges on whether or not the remnant habitat features garner a net benefit for agricultural production, for the conservation, or for both(Ribeiro et al.,2009). This is a particularly important issue in the tropics, where conversion to agriculture consumed 1.5% of the tropical forest biome between 2000 and 2006. To date, research on the relationship between natural vegetation cover and the crop yield in the tropics had focused on two agro-forestry crops: coffee andcocao . Both the coffee and cocao plantations consist of a mix of crop plants and (non)-native shade trees, which the results in an agro-forestry matrix that is comparatively hospitable to forest species , and can copious spill-over from forest and resulting ecosystem services. Consequently, these studies and analysis found that close proximity to

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forest improved pollinator bee numbers and thus coffee yields by up to 22% compared to locations 1,400–1,700 m from forest, and that distance to forest had a marginal positive effect on yield in cacao plantations, which have aggrandizing numbers of predatory ant and spider species with the higher densities of native shade trees. Furthermore, exclusion experiments showed that the bird and bat predation, and the extent of forest cover were important in controllingthe pest populations and thus positively impacting yield(Benton et al., 2003).

To our knowledge, the impact of the forest on yield has not been assessed in the context of tropical crop monocultures, in which the single crop species is planted in stands that do not contain non-crop trees or the other crop species, yet the majority of the crop expansion within the tropics now creates the monocultures of sugar cane, soya, oil palm, and even cocao. Oil palm Elaeisguineensis is one of the world's highest yielding and the most financially lucrative monoculture crops. As such, it is expanding verymuch rapidly, with production increasing by >5.5 million ha between 2001 and 2012 and with the majority of this expansion occurring at the expense of thehyperdiverse tropical rainforest in Southeast Asia. Unlike coffee and thecocao plantations, which can typically retain high levels of within-plantation biodiversity, whole-sale forest conversion to the oil palm results in dramatic local extinctions of most forest-dwelling species. To steeply reduce the environmental footprint of oil palm, The Roundtable for theSustainable Palm Oil (RSPO), via the high conservation value (HCV) forest protocol, and the conservation scientists have both highlighted the potential benefits of creating oil palm landscapes that retain the forest remnants and riparian strips within plantations, but the net effect of such management on the oil palm yield is not known(Hooper et al., 2005).

In the recent research, we explore the impacts of the local extent of forest cover and the proximity to forest on the oil palm yields in Sabah, Malaysian Borneo, where palm oil production covers 18% of the state land area and where there is increasing pressure for further expansion. We thus analyze whether the retention of forest within and adjacent to oil palm plantations has the positive, negative or neutral impact on oil palm yield, with the aim of informing and assessing sustainable land-use planning(Karp et al.,2013).

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The Ecology of Multicropping

In the ecological terms, multicropping is often more stable than sole or monocropping, particularly where inputs such as fertilizers, pest and the disease control, and also irrigation are limited or unavailable. In major temperate, intensive systems, sole crops are grown so that external inputs can be timed to meet the needs of a specific species. In this way, maximum productivity can be typically achieved within the limits set by the cost-effectiveness of inputs, the genetic potential of the crop, and the physical potential of its terrain. In such circumstances, multicrops are rare. In the less intensive systems, there is more likelihood of encountering mixed cropping(Ranganathan et al., 2010). Here, the devoid of inputs, such as nutrients and also water, means that resources must be sequestered from within the system itself and/or the spatial and the temporal demand for the maximum yield of a particular species must be balanced against the optimal performance of the whole system. The prevalence of the multicrops becomes greater as one move from relatively benign to more hostile environments and in major dry, tropical regions multicropping is often the dominant system of cultivation over the large tracts of land.

As well as the greater potential stability of themulticropping systems, it is also possible that certain combinations of multicrops may generate a greater yield than that achieved by their constituent sole crops grown under the similar conditions. Reported yield advantages vary but typically range between 25% and 42%, particularly for cereal/legume intercrops where an improvement in the yield fraction of the cereal component may more than the compensate for the yield loss incurred by the legume component. However, the farmers' preferences for multicrops are often unrelated to the possibility that they may garner greater combined yields per se than their constituent sole crops. Often, multicropping is chosen to decrease the risk of complete crop failure or to ensure the more stable range of yields in variable environments. The unreliability of annual crop yields aggrandizes with the inherent variability of the environment. Much of this annual variability is decreased when crops are grown together because environmental, pest, or the disease pressures do not equally affect different species. Pest and disease effects on one species may be decreased because specialized pathogens may settle on the non-host component species of the multicrop. This "fly-paper effect"

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encourages overall stability by the additional compensatory and increased growth of the resistant species in the space left by diseased individuals. For example, the virus diseases may spread more rapidly through adjacent plants of the same species than when these plants are much separated by dissimilar, non-susceptible, the plants of another species. Insect vectors are also discouraged from attacking plants that are typically intermingled with other species than when a single species is grown in a block(Sayer et al., 2013).

Multicrops comprising species with different times to full canopy resist the establishment of weeds and mayalso protect the soil against erosion and wind damage. Similarly the late planting of the second crop into one that is reaching maturity (relay cropping) is common in climates with the distinct wet and dry season where the rainy season cannot support and ally the growth of two full-season crops. In addition to usefully availing soil moisture that would otherwise be unavailable the following year, relay cropping can typically stabilize soil aggregates and the discourage weeds at the end of the first growing period. By availing crops of differing g durations and by adjusting the sowing date of relay crops into established crops, both the demand for natural resources, e.g., nutrients and water, and the human resources for sowing and also harvesting are spread across the season(Thies et al.,1999).

Allows specialized production

Economist had that specialization is a good thing as it creates economies of scale that maximize profits and minimize costs. The same principle applies to the agriculture, especially on the large-scale, industrial level.Running a far, requires a set of interdisciplinary skills combined with taking risks without being able to predict the outcome.

By cultivating and nourishing the same species, farmers can optimize their operations given that growing requirements, planting, maintenance (encompassing pest control) and harvesting will be the same across the farmed land. This allows for the planning ahead, taking time off and being prepared for each growing season when it's needed(Kremen et al., 2002).

Specialization also mainly enables farmers to develop in-depth knowledge and direct experience about their specific crops or the livestock. This is a great advantage in preventing significant losses before they

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happen, as farmers may mainly recognize warning signs of a disease right at the beginning or know how to mitigate damage caused by the unexpected weather. Smaller variety of generate reflects increase in production at a lower cost because the equipment and the farm management remain the same over the time. Additionally, buying seeds and supplements in the bulk usually means getting some percentage off the initial price which further pushes the costs very low(Sande et al., 2009).

Promotes technological advances in agriculture

It was monoculture that first allowed the deployment of the mechanization in agriculture and changed the lifestyle of people in many of the developed countries for good.

During the 20th century, the mechanization replaced the strenuous human labor in agriculture and started the shift towards industrialization–aggrandizing productivity, allowing more people to take on different occupations rather than just the farm for subsistence, bringing prices of food down, giving rise to the urbanization.

By planting the same crop on one field, farmers created as the uniform conditions as possible during any growth phase. Imagine: the same distance between rows and individual plants, the same size of plants in the same vegetative stage across the field(Chaplin-Kramer et al., 2011).



Figure:-1

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These were the perfect conditions for bringing in the machinery to take over the tasks like planting andspecifically harvesting that would otherwise require continuous manual work of many people.

Since the time when the very first tractors plowed the fields, the technology availed in agriculture has advanced even more. Nowadays, one can view the most specialized equipment that perfectly matches the needs of the farmers focused on intensive production of certain crops. Take, for example, the spindle-type cotton harvester. The specialized machine that harvests successfully more than 89 percent of cotton lint from a field and is capable of wrapping harvested cotton into bales at the spot.

As one can imagine this greatly reduces other labor that would be involved if farmers didn't own such a main technology(Landis et al., 2000).

When it comes to the advances in agriculture, we shouldn't forget even animal farms, where the technology progressed in the way that dairy cows are milked by robotic milking machines that also mainly feed them their individual feed portion based on the computer reading from each cow's chip. Or the manure cleaning robots that promptly remove manure from large stables(Klein et al.,2003). There are several integrated techniques like fertigation, herbigation being carried out (Sreeremya, 2017).

Increases efficiency

The main and prime reason why farmers decide for monoculture agriculture is their desire to maximize theoutput and minimize labor that is involved.

It is as simple as it sounds, and it greatly improves theefficiency of tasks and processes that take place during the production.

Monoculture can play to the pros of the local climate and soil conditions. Crops that are best suited for the land are planted so that the soil and the climate specifications, such as winds, droughts or the short growing season, don't impact the yield as much.

For example, continuous monocultures of wheat are cultivated on the fields across Texas and Oklahoma. Farmers stick to this commodity crop out, mainly of practical reasons. These areas get too little annual rainfall to support other commodity crops without the irrigation (Rencher et al., 2002).

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Maximizes yields of some produce

Annual cereal crops simply have higher and increased productivity and are easier to manage when planted as monocultures rather than melanged with some other crops on one plot(Mengel et al.,1979).

However, there is one very important condition that affects this higher yield. These crops need to be managed under the crop rotation scheme of alternating at least two different monocultures on one field. The reason is simple and practical. Crop rotation allows soil recovery and interrupts pest cycles .

Examples of rotation schemes can look like this:

- wheat rotated with canola, followed by two years of being fallow
- wheat, canola, barley and fallow period
- two years of corn and one year of soybean
- Rotation schemes can differ greatly, and it depends on each farmer to select the most convenient one for the local conditions(Little et al.,1972).

CONCLUSION

Monocropping has its own pros and cons. Many of the farmer's domonocroppingto understand completely the potential of crop on that soil. This paper garners the different aspects of monocropping.

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