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Traditional versus modern agricultural practices in mixed cropping system in Dehradun

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Abstract

The entire experiment and research was conducted to compare the various types of the parameters between traditional and modern mixed cropping system. The complete experiment was done in 4 different plots consisting a couple of traditional farming and modern farming. The experiment was carried out as a thesis work for the M.sc Agronomy students under the Matty organization under the supervision of Dr Ankita Rajput and Dr. Ved prakash kumar. The experiment was conducted by comparing the different parameters between the traditional and modern method of mixed cropping systems like cropping system, yield, manures and fertilizers etc. The study revealed the difference between these two cropping system also shows its affect on the different parameters. It demonstrates how modern cropping system helps to achieve more yield then traditional system. Apart from the parameters the experiment also tends us to understand the beneficial aspects of these both types of cropping system as well as clarify how modern system of cropping system is more helpful and beneficial for the farmers. The study helps to get the overall factors responsible for the modern agriculture and shows the differences between the methodologies, techniques, traditional believes, ancient system of farming and various types of practices that have been carried out by the ancestors in the agricultural sector. The modern agriculture system shows how the agronomical method of pesticides and insecticides are replaced by different chemicals.

Keywords: Matty, yield, methodologies, ancient, pesticides, insecticides

Introduction

Mixed cropping is all about growing 2 or more crops of same or different species at a same place at a same time. Therefore the crop has interaction with each other which results in the overall growth and senescence both in above and ground plant parts. The present study of research is to expose the traditional farming system in sustainable development also the modern study helps to make the system better and advanced.

There is competition for resources throughout the growing season in mixed cropping system. Shifts from traditional to modern agriculture will have significant implications for the biodiversity of cultivated plants. In today's context it is necessary for agriculture to remain resilient to maintain and increase the food standard. As the world is turning into a scientific global village, traditional agriculture practices and knowledge becomes obsolete. As a traditional land use system the practice of the mixed farming system has increased through the ancient civilization to the modern era (Mohri *et al.* 2013) [38]. Farmers might have been neglected some traditional varieties that does not support their livelihood so that the modern system of mixed farming had given the hope for the farmers to carry out the modern and scientific method of cropping system

Another study by (Seufert *et al.* 2012) [59] revealed that traditional system of practice system of practice has 25% lower average yield then the modern practice. Also the mixed cropping shows the 80% higher profit and yield then the individual practices.

The mixed cropping historically was documented by the Seneca and Liquids tribes in the US northeast probably 1000 years ago. This method generally consists of planting 3 seeds at a same hole. Asian countries are considered as the second place after Europe and US for practicing the mixed cropping system. The growing literature and research has provided well maintained frame work for providing the excellent result in these sectors.

Numerous community and sectors are working in the establishment of the modern techniques and process of farming in the current ongoing situation. The traditional system has provided the proper knowledge and method of the farming system where as the modern method of

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farming system has developed the cultivation system by reducing the cost, labor and less destruction of the natural resources. More efficient and greater research effort is needed for developing the new farming system to provide the better option for all the related components of the agriculture system.

In India the practice and concept of mixed farming was introduced in 1951. Mixed farming was largely practiced in Odhisa and Kerela. In India it is not of recent origin. This changed the life style of early man from random farming to the advance farming. Various traditional practices are reported with distinct features towards the context of environmental safeguarding towards the excess use of chemical fertilizers which contaminate the agro system (Joshi and Singh 2006) [25]. According to the resources the practice are based on the crop protection mechanism. Indian agriculture comprises a dynamic diverse which results the various soil type, vegetation, ecological adaption and survival capacity. In India ICAR was established in 1929 to conduct the different research on the food crops which aid in the government for financial support under the commodity ACT of 1923 (Randhawa 1979) [51].

Methodology

The research was carried out in two different forms. At first, we observe the traditional method of mixed cropping system and then we collected the data from the field such as: cropping pattern, plant density, types of crops, irrigation methods, seed quality, yield attributes, tillage practices and other various types of different parameters which can be collected in the traditional practice system of mixed cropping. Secondly, we visited the modern practice of mixed farming system where we observe the same parameters as the traditional method system.

Finally we compute the differences between the two types of the cropping system where we know the differences about them and can relate the practices advantages and disadvantages.

We studied various types of the journals and research paper which was available in the sites like Google scholar, Google search where entire findings and research was made by best scientist and researchers. Also we got the ideas about the history of the findings related to our subjects through the thesis papers and dissertation which was available for free in those sites. We also took help from some expertise who guided us throughout the findings and made our work much easier and faster. We also gathered various findings from the 19th century to the modern era which contains all the information that were made by the researchers and scientist which helped in our research. The journals and the research paper that was received from the various sources like internet excess and some of the thesis and articles demonstrated the entire history about the type of cropping system from the past era to the modern time period which makes our study easy since we can compare the entire operations from the past time to the modern time of cropping system.

In the other hand when we made our visit in the field for the collection of our data we met the modern as well as traditional farmers who gave us the proper knowledge about the farming system. The farmers also explained about the type of the cropping system in their era and modern time period. Most of the data and findings are done while interviewing with the farmers and they also explained about the advantages, disadvantages, availability, role, and other different factors that play the direct significant to their cropping system. The

complete study was done by comparing the various types of the parameters like tillage operations, cropping pattern, type of intercropping, yield between the two subjects which is modern mixed cropping and traditional mixed cropping. The entire parameters were closely studied before drawing the conclusion and the differences were noted in the overall performance of the yield. The farmers explained well about their cropping and plantation system also they showed us the entire field which was much beneficial for our research.

Results and Discussions

The entire research and the results are concluded on the basis of the various studies of the researchers and scientist who have given us the facts and findings which had played a great role in making our study easy. Also we are able to observe the ancient data and objectives which would not be possible without the contribution of the researchers and scientists who had contributed a lot in the agriculture sector.

When planning the modern mixed cropping pattern it is important to take into account the different characteristics, features, and various types of the components of the mixtures especially the growth habit to avoid competition (Vandermeer 1989) [42]. For example: root system of different species often avoids each other (Silver town 1982). The best solution to alleviate the competition includes the adjustment of seeding time and densities of the component species to maximize the plant stand productivity (Davies *et al.* 1986). In modern mixed cropping system there is higher number of plants per unit area differences in pest and pathogens resistance as well as stress tolerance of different plant species and cultivars. Due to the dense plant stand the foliage and root covers the larger area which increases the radiation (Keating and Carberry 1993) [27], water (Marris and Garrity 1993) [39], and nutrition (Midmore 1993, Morris and Garrity 1993) [36, 39].

The traditional agriculture practices are much more adaptive to the local environment which is based on the indigenous local knowledge which might be failure sometimes. In the other hand (Berkes *et al.* 2000) [9] explained the traditional agriculture practice as the set of knowledge practice trust which passes through generation to generation through a cultural transmission and also shows the relationship between the living beings with their environment. Traditional farming has a unique character with respect to physical and biological aspects which shows the differences between the natural and semi natural with the various types of the different crop diversities (Plieninger *et al.* 2006) [41]. The competition between the plants of mixed cropping with other crops can be dominated along the alteration in plantation date. The modern mix and intercropping is considered better for the weed control because the large biomass and better covering of soil eradication of weed and prevents its growth (Banil *et al.* 2006) [10]. As the traditional land use system, the practice was evolved from home gardens which become the farming system in the ancient civilization (Mohri *et al.* 2013) [38]. The study in traditional system was carried out in the 3 countries, Indonesia, Sri Lanka, and Vietnam. The frame focuses on the actual interaction and linkage between the two types of the cropping system, which helps in the demonstration of close interaction among the farmers. The traditional farming system has provided the financial resilience to the marginal farmer's family and the diet and nutrition enhances the security of the global population (Johns *et al.* 2013) [64].

Modern agriculture and modern farming has been progressive and much more beneficial for today's farmers. The modern use of technology has tended in less labor and higher yield

efficiency (Kate M. 2017) ^[65]. The mixed and traditional agricultural practices are widely distributed in many parts of India which consists of Himalayas region where the maximum population depends upon the natural resources. The proper utilization and mobilization of natural resources are thus seen in the parts of Himalayas. Mono cropping is completely failure in the sustainable manner so that the traditional mixed cropping is used to minimize the risk of pest (Singh and Singh 2017). Intercrop and mixed cropping has been playing the significant role in enhancing the productivity in extreme weather and low input farming. The yield was recorded in higher number in comparison to the mono cropping because of variable adaptation to the climatic threats in modern agriculture (Shava *et al.* 2009 and Hu. *et al.* 2017). The comparison between the organic and modern agriculture practices were done to analyze the yield attributes between the organic and modern agriculture practices at the global scale and was recorded a larger output of organic practices over the modern one (Badgley *et al.* 2007) ^[8].

Crop rotation refers to the practice of cultivating a same or different species of crop on the same piece of land (bullock 1992, Dury *et al.* 2012) ^[67, 68]. A study revealed that traditional or the organic based agriculture has 25% lower average yield than modern practices, whereas the comparison between the higher yields shows the production was 13% lower than the modern practices (Seufert *et al.* 2012) ^[59]. Crop rotation is considered as the sustainable approach that levels up the yield and moisture content by reducing soil erosion (Haug *et al.* 2003) ^[69]. The crop rotation of different crops with minimum tillage produces the developed network of roots which consists of large micro pores which helps in increasing the availability of water to the crops. Also, the percolated water in the lower depth promotes the microbial diversity that helps in minimizing the water loss as infiltration and evaporation which is responsible to prevent the pathogen outbreak (Hobbs *et al.* 2008) ^[21].

Cover cropping is an important approach for enhancing the overall health of the soil, nutrition cycle, ecosystem and human well-being (Mohri *et al.* 2013) ^[38]. Weed and pest management and water storage (Schipanski *et al.* 2014) ^[71]. The sudden change in the rural farming system and the farmer's movement towards the commercial farming has increased the farmer's household income level as seen in most of the farmers. After that the attention has been drawn towards the complex issue along with the policy makers (Herath *et al.* 2013, west and haug 2017) ^[38]. Cover crop also plays the vital role in the sustainable tool act and water nutrition on conservation technique (Ranells and wager 1996) ^[50].

This practice of cropping pattern has been recaptured the global attention to overcome the problem the problem in modern agriculture system by helping in the soil quality, soil moisture content and other different types of land, soil and plantation method (liu *et al.* 2016) ^[72]. The long term use of the organic compost as a single or in combination of NPK fertilizer is found to be enhancing the sufficient amount of the micro nutrients such as P, K, Mg, Ca, Zn in the top most layer of the soil (Bedada *et al.* 2016) ^[74]. Important components of agro biodiversity can be lost due to agricultural intensification and mono culture habitat loss, market modification, and other various factors (Rudebjer *et al.* 2011) ^[49]. Nowadays farmers might have abounded some traditional varieties that no longer support their livelihood and soon the entire system will turn out to be completely modernized (Rudebjer *et al.* 2011) ^[49]. Cropping pattern helps to utilize the various types of

resources and increase the biodiversity and stability of agro system (Zhag and Li 2003) ^[57]. Analysis of the proper experiment helps to find out the increasing crop intensity from single to multiple cropping systems enhancing the carbon sequestration (west and post 2002).

The research work that includes the sum up of the variety of experimental findings was conducted by the commercial farmers. Still the investigation is under process including the crops, cropping tillage and manures treatment which also includes the chemistry, entomology and hydrology. By the year 1920, it was concluded that the crop rotation alone cannot improve the soil fertility (H. weinneman 1998). (Badgley *et al.* 2007) ^[8] attempted to analyze the yield comparison between the traditional and modern agriculture which is carried out in the global scale and documented large profitable practices over various types of practices. Some traditional practices that are only cultivated in the specific place by the local community tend to be a good earning source among the farmers. The demand of the unique practices of crop has developed a good source of income between the market and farmers (Abia *et al.* 2007) ^[66]. The comparison between the organic and modern agriculture practices were done to analyze the yield attributes between the organic and modern agriculture practices at the global scale and was recorded a larger output of organic practices over the modern one (Badgley *et al.* 2007) ^[8]. The yield that is obtained from the agricultural system is the benefit derived in the form of profit, social, and ecological factor. The main theme of sustainable agriculture is high production on worldwide cultivation (Godfray *et al.* 2010) ^[16]. the crop/species level adaptation is affected by agro forestry, livestock, integrated farming system and diversification of the land structure with the cultivation of the various crops (khan *et al.* 2011) ^[70]. Apart from the above mention practices, there are some other types of factors which affect the cultivation practices and some regional stress of climate like drought flood and salinity which has greater role in adaptation of the crops (Kumar *et al.* 2010) ^[13]. The application of FYM is considered as the best alternative method to restore the soil fertility in the economic condition (Vanluwe *et al.* 2010).

Growth advantage for inferior species of the mixture can be achieved for example by seeding the dominant species later than other species (Andersen *et al.* 2015). Tillage is defined as the mechanical or the physical manipulation of soil for the purpose of better crop production. They are generally characterized by soil water conservation, soil temperature, infiltration and other different parameters (international soil and water conservation research 2015). Despite of using the cover crops the farmers are found using the legumes cultivation along with the legumes cultivation along with the mixing cropping system. This is because the legumes crop provides the nutrient stress condition through the symbiotic nitrogen fixation of rhizosphere bacteria (Mao. *et al.* 2015). Tillage system and methods has the great impact on NO₂ emission (Rattan Lal 2021) ^[73]. So the study about the different system of farming practice helps to estimate the nature, growth, patterns in the mixed cropping system. The close study of the difference between the practices of tillage in the two different system helps to find the evolution of tillage from the past to present time period.

The utilization of the available resources in the systematic manner develops the site specific agricultural practices that are compatible with the various adverse climatic conditions as well as the habitat and various types of diversity (Lincoln 2019) ^[75]. It has been recorded by FAO and IFAD in 2019

that most of the family has just survived by the home yard farming which has played a greater contribution of the global food production. Important components of agro biodiversity can be lost due to agricultural intensification and mono culture habitat loss, market modification, and other various factors (Rudebjer *et al.* 2011) ^[49] Nowadays farmers might have abounded some traditional varieties that no longer support their livelihood and soon the entire system will turn out to be completely modernized (Rudebjer *et al.* 2011) ^[49].

Conclusions

After the entire study and research we hereby came to conclude about the facts and findings about the traditional and modern mixed cropping system. The findings told us about the difference between the various agronomical practices which have been practiced from the past era to the modern time period. The difference between the modern and traditional mixed cropping system illustrate the variation between the various types of parameters like cropping system, manures and fertilizers, type of cropping system, yield attributes and various types of the other factors. The entire reviews and thoughts given by the various famous personalities helped us to compare the cropping system from the different time interval. Some research which we took the reference have the important findings and information which can be used for the upcoming generations which will help them to proceed with the further research and more findings about these subjects.

Moreover there is some information lacking about the findings which makes the research a little complicated to understand for the first time reader. Some past research and findings consists of those data's which are not applicable in modern research. Also there are some of the explanations given supporting the traditional system as much more beneficial and easier than the modern system, but there should have some stronger reason to prove the beneficial aspects of the modern farming system too.

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