

Cultivation Of Wheat And Chickpea Intercropping Under Organic System Of Production: A Review

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Abstract: *Global population increases drastically but the production of quality food grains has decreased in the same way that may results the poor nutrition content in the food. The reason behind less quality of food grain is the continuous use of chemical fertilizers in field in order to produce higher yield but these inorganic fertilizers increase yield and other side it decreases the soil fertility and cause effect to soil ecofriendly organisms and cause pollution in the soil and environment. Instead of using those inorganic fertilizers replace with using organic amendments like FYM, Poultry manure, Vermicomposting, sheep and goat manure, bone meal, slurry, sewage and sludge along with the bio fertilizers plays key role to enrich nutrient content, increase microbial population, improves water holding capacity in soil and provides the better aeration around plant rhizosphere. Growing of sole crop with organic amendments may reduce yield. Instead of these we fallow intercropping systems like cereals + pulse, cereal + oil crop, cereal + cereal crop may provide the better production and among intercropping systems cereal +pulse crop of wheat and chickpea with recommended ratios of (2:2,3:1,2:1,1:1) has shown the better results in crop production with good quality grain yield ,LER, better growth rate per unit area by better utilization of N₂ from legume crop by fixation and makes profit to the farmer by reducing the incidence of disease, pest and weed .*

key words: *organic farming, intercropping, Global population, chemical fertilizers, quality, yield, soil fertility, environment.*

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is the first preferred staple food crop of the world and second important cereal crop in India as a staple food ,area and production. India has a gradual increase in production and stands in the second largest producer just beneath the china.(Kumar and Yadav,2006).Wheat is the best food crop that has a required quantity of Carbohydrates(78%),proteins(11-12%),fat and minerals (2%) and better amount of vitamins . Nearly Above 80-85% wheat grains are used to make flour. As per FAO estimate, World would require 840 MT of Wheat by the year 2050.

Chickpea(*Cicer arietinum* .L) is the essential pulse crop of rabi season in India. It is mainly preferred to grown in semi arid and warm temperature regions and moreover chickpea (*Cicer arietinum* L.) is known as one of the important grain pulse crop in the world (Namvar et al., 2011).Due to its high nutrition content chickpea is consider as most preferred crop in the famine areas of



the world .chickpea seeds contain protein (21%), carbohydrates(61%) and oil(2.2%)(Gupta 1988).Chickpea is major legume food grain and an important constituent of protein in many countries.It is used in crop rotation(Sachin and Gecit,2006) due to its nodule farming ability it is used to restore soil fertility by crop rotation (Baldav,1988)and can fix the atmospheric N_2 (Jain et al.,1999)and can hasten its role in soil fertility(Gunes et al.,(2006) and other most thing about the intercrop is that it plays crucial role in organic farming system(Mohammadi et al.,2010a)

Organic farming is an ecofriendly farming system that which rejects the use of chemical related fertilizers, growth regulators and pesticides. Combined use of organic amendments will provide great benefit. By the application of organic manures like FYM, ,V.C

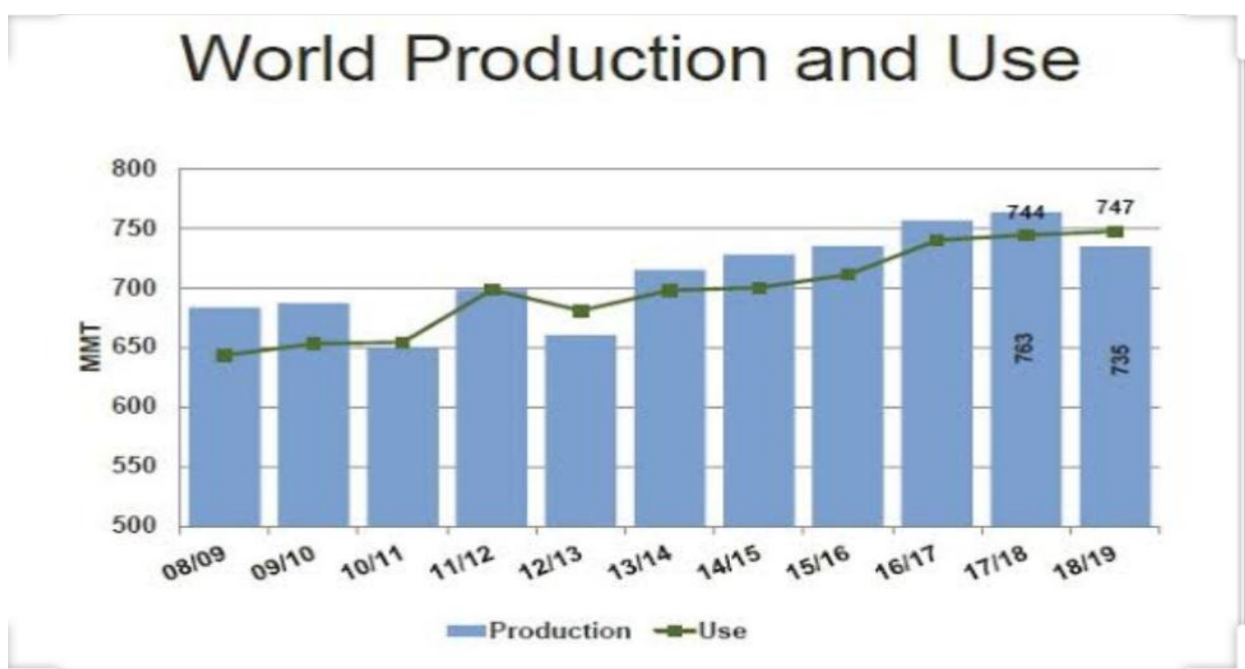


Organic manures(FYM,Vermicompost,Green manure,Bonemeal,Slurry,Poultry manure,Sheep manure)

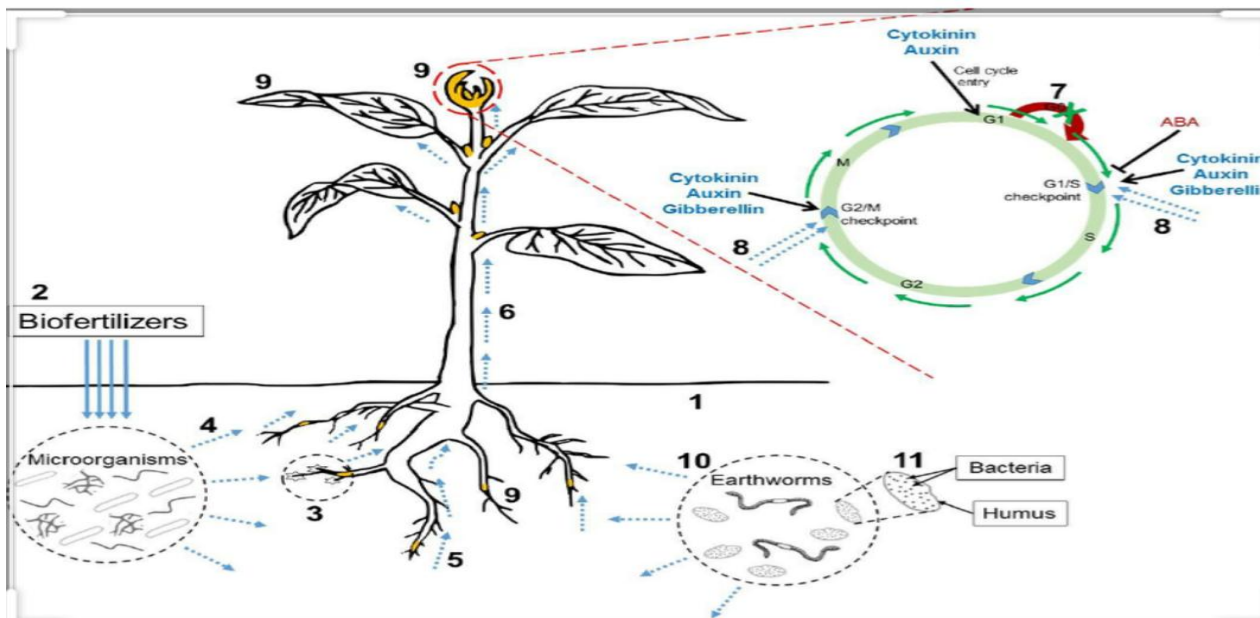
(Vermicompost),(P.M) Poultry Manure, Goat, Sheep Manure, Sewage, Sludge, Slurry to the soil and their incorporation may helps in increasing soil fertility and productivity, and improves activity of soil microbes , plays crucial role in transformation, recycling and make favorable conditions for nutrients uptake to crop and improve the capacity of soil that which makes the soil healthier and provide good aeration for seed germination and development of roots around rhizosphere. To reduce the nutrient deficiency in soil and makes to help the nature for better buildup condition . Organically available source of nutrients are the better usable resources that can promote soil health, plant growth and microbial development and provides equal opportunity for all living existence to live and support the N_2 fixation, P solubilization, recycling of animal wastes. Characteristics of soil is influenced by the quality and type of organic amendments and its influence in nutrient uptake by the crop may variable (Abbas et al.,2012). However, using organic amendments for long time may definitely help in increasing the soil characteristics that which is very effective and safe to environment (Khaliq et al.,2006).

world organic wheat production and use

Bio fertilizers are alternative to reduce the chemical fertilizers and decreases the effect that case to the soil environment and nature (Namvar et al., 2011). Using PGPR (plant growth promoting rizobacteria) as a bio fertilizer has resulted the most ecofriendly and improves the nutrition containing in soil by interact with rhizosphere with the help of microorganisms



present in them and better helps in growth of the plant. These bio fertilizers does not pollute the environment and makes safe use for the produce purpose of the crop. Bio fertilizers provide indole acetic acid, gibberellins, biotin and vitamin B that helps in the growth of crop and its yield. PSB (Phosphate solubilizing bacteria), azospirillum, azotobacter and rhizobium increases the disease and drought resistance of the crops. These bio fertilizers are cheap as



compared to the chemical fertilizers and improves 15-20% yield.

Intercropping plays a crucial role in organic farming. It is the routine practice in many countries. It acts like safeguard crop against failure of sole crop and provides the additional income to farmers. It also increases the total available area utilization per unit by better utilization of land, labor and growth resources. The shortage of pulses may result malnutrition in human being due to less growing area hence we need to increase their per productivity. Here intercropping plays a vital role in maximum utilization of land without endangering to the cereal crops. Intercropping plays a crucial role in providing additional yield as compared to growing of sole crop that economically beneficial crop production system. When growing the cereal and pulse crop as main and inter crop with different growing conditions then both the crops definitely benefited in the yield and soil nutrient uptake (Singh, R.V. and P.C. Gupta 1994) by growing intercrop provides the better economic returns and higher yield advantage as compared to sole crop. Tremendous utilization of resources can be increased with intercropping (Tilman et al., 2002; Gao et al., 2014; Nasri et al., 2014). Intercropping also plays a major role in better utilization of resources like water, nutrients, solar energy and provide better profits by increasing yield (Morris and Garrity, 1993; Nasri et al., 2014) decreases the influence of diseases (Eskandari, 2012) and enhance soil fertility (Lithourgidis et al., 2011; Swer and Dkhar, 2014). In developing countries, intercropping is practiced as to mono-cropping which gives the farm income much better of double crop with double income when Wheat (*Triticum aestivum L.*) was intercropped with Chickpea (*Cicer arietinum L.*) (Akhtar et al., 2010)

**organically
and chickpea
improves**

- 1.Yield**
- 2.Quality**
- 3.Nutrients**
- 4.Nitrogen
nodule**

1.Yield

Roshan choudary,
conducted the
application of Go
@0,5,10,15,20



**grown wheat
intercropping**

**uptake
fixation and
development**

et.al. (2017)
experiment by
Bhu sampada
g/lit water and

sprayed in organic wheat has shown the better result in higher number of tillers/plant (358.81), test weight (41.49 g) and grain and straw yield of about (26.23 ,62.53 q/ha)

Abbas G. *et al.*, (2012) by conducting the experiment to know the effect of organic manures with recommended dose of N, P, K on wheat and he reported that by application of different combinations of FYM, vermicompost and poultry manure along with NPK as sole and combined application among the all combination of poultry manure and NPK ratio of 128:114:62 kg/ha shows the better result in grain yield and inorganic fertilizers shows substitute for the production.

Verma H.P *et al.*, (2017) conducted the experiment to know the effect of yield over different irrigation scheduling and organic manures application and reported that application of FYM and vermicompost @7.5 t and 3 t /ha shows the better result in more number of tillers, grain number/ear, test weight, straw, grain yield, biological and Harvest index as compare to other treatments.

Fazily T, et al.,(2019)by conducting the experiment at Department of agronomy in UASD Dharwad and reported that application of RDF and Farm yard manure of 7.5 t/ha shows the better result in the more tillers, higher ear length, more grains, higher test weight, more grain yield,

straw yield and protein content.

Yadav A. S et al., (2017) conducted the experiment to know the effect of organic manures in production of wheat and reported that application of RDF @120:60:40 kg/ha show the better

result in max plant height, more shoots, LAI and also shows good dry matter production, grain and straw yield. When it comes to only organic amendments combined application of decomposed rice straw+PSM (phosphate solubilizing mycorrhiza) +pressmud@10t/ha shows the better result.

Hammad et al., (2011) conducted the experiment to know the influence of organic manures on wheat productivity and reported that mixed use of green manure along with 10 t/ha sewage and sludge and poultry litter shows the higher yield of about 3.65 t/ha which is highest as of 137% more to control and economically beneficial.

Ajaypal Singh et al., (2018) conducted the experiment to know the effect of organic and inorganic amendments in wheat growth and yield of wheat and reported that combine application of RDF@50% +sewage and sludge @0.4 t+ bone meal of 0.25 t/ha have shown the better effect in plant growth like height, leaf area, no. of grains/spike and yield.

Ahmed M.E.M et al., (2010); reported that combine use of the chicken manure + cattle manure, pigeon manure +chicken manure, cattle manure, rabbit manure shows the better result in plant height, no. of leaves, no. of branches, leaf area, no. of pods, seed index, seeds total yield and content of Phosphorus and Potassium in seeds and phosphorus in leaves and also said that Organic Manure could be safe, cheap and environmentally friendly substitutes to mineral fertilizers.

Sevgi CALISKAN et al., (2012); he conducting the experiment to know the comparison of organic and traditional production systems in chickpea (*Cicer arietinum. L*) by application of traditional, FYM, GM (green manure), GM+FYM and from his experiment reported that highest seed yield obtained from traditional system where as highest protein content obtained from G.M+FYM application.

Khan et al., (2017); conducted the experiment in agronomy farm in the university of agriculture Peshawar, Pakistan in order to know the effect of FYM and Rhizobium inoculation on growth of chickpea. By the application of FYM at 0,5,10,15 t/ha and seeds are treated with and without rhizobium at end reported that application FYM@15 t/ha shows higher plant yield and treated seed plots shows the higher nodule /plant. Finally reported that the combination of both gives the better result.

Vivek Sharma et al., (2018); conducted the experiment to know the synergetic effect of bio inoculants on yield, nodulation and nutrient uptake of chickpea (*Cicer arietinum L.*) under rainfed conditions and reported that the combine application of Rhizobium +PSB+AM fungi +Azotobacter as seed treatments with 75% of recommended P(Phosphorus) produced higher grain yield and also nodule number, nodule weight, CFU (colony forming units) and improves crop health.

Mahmoud et al.,(2018);after conducting 2 years field experiment from 2015-17 in experimental farm, faculty of agriculture Menoufia University Egypt .Reported that application of bio fertilizers (F4) treatment in field shows the best result in case of increase in no.of branches/plant, seed wt,straw wt and biological yield/ha and (F5) organic fertilizer application shows the highest fiber and ash content and (F6) combination of (F2)macro+(F3)micro nutrient+biofertilizers+organic fertilizers shows

Das et al., (2011) reported that total dry matter(CGR)crop growth rate, RGR (relative growth rate) higher in sole crop and among in intercropping system growth parameters highest at (2:2) chickpea wheat and lentil-wheat (3:1) wheat sole crop shows the (highest tiller no, plant height, spikes/hill, spikelet's/spike, grain/spike and grain yield) sole chickpea crop also shows the highest branches, pods/plant, seeds/pod and grain yield.

Balwinder Singh and C.S. Aulakh., (2017) conducted the field experiment in PAU (Punjab Agriculture University) in 2017 to know the effect of growth and yield of wheat + chickpea intercropping under limited nutrition and moisture and reported that wheat + chickpea at (2;1)

ratio gives higher yield (54.6 q/ha) than sole crop wheat (46.7 q/ha) whereas wheat grain yield of wheat chickpea rows ratio of (1;1 and 3:1) were statistically at par with sole crop.

Khatun et al., (2012); had done the experiment in Bangladesh to know the effect of different intercropping systems in wheat and finally report that sole crop of wheat shows higher result and when it comes to intercropping systems wheat and cowpea has shown the better results of HI, LER and higher equivalent yield and wheat and lentil shows less yield.

Eskandari.H.et al., (2009) reported that intercropping had a significant effect on forage dry weight, where dry intercropping as compared with maize and cowpea sole crops. maize forage crop quality in terms of crude protein was improved.it is because of more N available for maize in intercropping compared with its sole crop.

Lithourgidis et al., (2007) reported that economic yield and growth of intercropping system is good as to sole cropping system.

2.Quality

Davari, Sharma S.N, Mirzakhani (2012) reported that combination of organic manures and bio fertilizers gives better quality grain and improves the nutrient up take by the grain by the combination of Farm yard manure, Rice residue, bio fertilizers and vermi compost, rice residue, bio fertilizers.

Lauk and Lauk(2005) reported that legume cereal intercropping gives the better result in grain yield and protein content as to normal sole crop.

3.Nutrients uptake

Zahir Z.A. et al., (2007), by conducting the experiment to know the effect of composted organic manures that is enriched with the N and application of L-Tryptophan @500 kg /ha for wheat and compare with inorganic fertilizers and reported that integrated use of both inorganic fertilizers and composted organic manures that has applied with L-Tryptophan shows the better result in primary nutrients uptake, better growth and yield.

Zhikang Wang et al., (2019) reported that co inoculation of both the PSB (phosphate solubilizing bacteria) and NFB (nitrogen fixation bacteria) perform better as compared to sole application of PSB, NFB of growth promotion and nutrient uptake.

Balwinder Singh et al., (2017) Intercropping wheat and chickpea along with manuring are important to enhance crop productivity, moisture holding and nutrient uptake. He reported that whea+chickpea (2: 1) shows better result in tillers, no. of grains/spike,1000 grain weight of wheat as to sole crop and better grain yield and water use efficiency in (2:1 and 3:1) ratio cropping.

4.Nitrogen fixation and nodule formation

Aslam M.et al., (2003);conducted the experiment in order to know the N₂ balance difference between N₂ fixation in inputs and N₂ harvested products rotational benefits of chickpea on soil organic fertility and wheat yields were quantified in northern Pakistan and reported that N added to soil of 28 kg from chickpea to field and used by wheat and increase soil organic matter to 30% and experiment indicated that chickpea have + vet N₂ balance and yield in wheat increase by combination of fertilizers and chickpea (106%).

Gill.S et al., (2009); conducted the pot experiment to know the wheat and chickpea on their growth and nodulation in chickpea and reported that when both crops grows mixed wheat has an inhibitory effect on root, total biomass, grain yield of chickpea, nodulation activity and root: shoot ratio decreases contrary to chickpea wheat is beneficial by increase 100 % and better (H.I) harvest index and greenness of plant is not effected.

Joseph Kevin vessey (2003); from his experiment to know the use of plant growth of promoting rhizobacteria in rhizosphere and report that it has a positive effect in the

rhizosphere by better nutrient availability, by fixation and good root, shoot growth, and enhance other beneficial organisms in the soil.

Ghaley et al., (2005) conducted the experiment to know the effect of intercropping of wheat and pea and reported that growing of pea as an intercrop in wheat shows the maximum yield as compared to sole crops and control plot without fertilizers and results the better grain production. The main reason for this is the better utilization of N and N₂ accumulation released in the rhizosphere by the intercrop.

Advantages of intercropping

1. Better utilization of resources

2. Erosion control

3. Weed suppression

1. Better utilization of resources

Liu et al., (2006) There is a yield advantage in intercropping as compared to sole crop mainly due to better using of the available resources such as water, light and nutrients.

Gao et al., (2014) had conducted experiment on wheat-maize intercropping and suggest that more Nitrogen use efficiency in intercropping system as compared to sole crop.

Ali (1993) had done the experiment on wheat-chickpea intercropping and suggest that there is more light interception and transmission of light observed in 2:2 ratios that results better LER and yield.

Eskandari (2011) said that growing intercrop is more beneficial as to normal crop in nutrient uptake and yield by conducting experiment he observed that 40-70% advantage in wheat maize intercropping and 28-30% in wheat -soybean intercropping.

Erosion control

Davidson (1994) reported that well controlled intercropping results in better soil and water conservation as to normal sole crop.

El-Swaify et al.,(1988) legume crop as a intercrop may helps to give better result in soil erosion and sustainable produce of the crop. He observed that reduction in soil loss and runoff when legume crops grown as a intercrop in cassava.

Weed suppression

Liebman and Dyck (1993) The major benefit of intercropping is that it suppresses the weeds.

Banik et al., (2006) conducted the experiment on wheat, chickpea intercropping and monocropping and reported that intercropping results increase productivity per unit area and suppression in weed biomass.

Eskandari (2011) done the experiment in wheat and faba bean intercropping and reported intercropping is more beneficial in controlling weeds than sole crop that less available of resources to weeds due to intercropping.

Issues and disadvantages of organic wheat growing farmers

Todd Birzer et al., availability of nutrients to plants by organic fertilizers like FYM, V.C, P.M and bio fertilizers is little time consuming as compared to inorganic fertilizers and results less initial growth and less yield in the plant of first few years. Certificate issue for the organic farmers due to less known about the procedure pf certification. Organically grown wheat and chickpea faces little weed problems and reduce yield due to less nutrients availability to plants taken up by the weeds as compared to herbicide applied. Market demand is high but the productivity to supply is less and not known the farmers about better tactics to sell his organic products in market.

Intercropping sometimes going to be disadvantage based on type of crop selected results competitive for light, water, nutrients or allopathic effect and reduce the yield. However,

Intercropping is beneficial up to some extent but for large scale basis, management is little less possible and inefficient (Vandermeer,1989)

2. CONCLUSION

Intercropping is the one of the important cropping pattern in the modern and traditional organic farming system that it provides the beneficial nutrients to the primary crops by biological fixation of nutrients and gives the additional income to the farmers. Organic growing of crops by combine using of different amendments like FYM, Vermicomposting, Poultry manure, Rice straw and bio fertilizers like Azotobacter, Rhizobium, PSB, PGPR and other organically derived compounds at recommended doses has shown the better growth, LAI, quality and quantity of both chickpea and wheat-based intercropping.

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