https://doi.org/10.56572/gjoee.2022.si.0008

INFLUENCE OF LOW COST NATURAL FARMING, ORGANIC FARMING AND CONVENTIONAL FARMING ON PERFORMANCE OF WHEAT AND CHICKPEA

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ABSTRACT

The present investigation was carried at the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat during rabi season 2019-20. An experiment was conducted in large plot technique to investigate the performance of wheat and chickpea under the influence of low cost natural farming (LCNF), organic farming (OF), and conventional farming (CF) under medium black calcareous clayey soil. Results of the experiment indicated that significantly higher growth, yield attributes, yield and quality of wheat and chickpea under conventional farming system that included application recommended dose of fertilizers along with FYM; chemical control of weeds, insects-pests and diseases, being at par with organic farming only in case of performance of chickpea.

Keywords *: natural farming, organic farming, conventional farming, recommended fertilizer dose, farmyard manure*

INTRODUCTION

Farmers all across the world used to grow organic food before the 1940s, when the population was much lower than it is now, and yields were comparable to those of prehistoric times. As the world's population rose, growing organic food was no longer a viable option for feeding the world's population. To ensure food and nutritional security for the growing population and to increase income, there is an urgent need to enhance resource use efficiency, reduce input costs and improve crop yields. According to the International Food Policy Research Institute, the world needs to double food production per unit area/day. This calls for an urgent need to identify potential alternative farming strategies to achieve long term sustainable food production and food security.

To meet the demand of increasing population, farmers attract towards the use more and more chemicals in order to gain higher yield. Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high interest rates for credit, the volatile market prices of crops, the rising costs of fossil fuel based inputs, and private seeds. Indiscriminate use of chemical fertilizers and pesticides posed a threat to the soil and environment. Many investigations have shown their adverse effects of change in soil nature, soil contamination, ground water pollution, decrease in soil micro flora *etc*.

Natural farming mainly depends on the natural inputs which increase water holding capacity, aeration, organic carbon, enrich the soil with humus, and increase microbial activities. By adopting LCNF, over time shows improvements in yield, soil conservation, seed diversity, and quality of produce, household food autonomy, income, and health. Savings on the cost of seeds, fertilizers and plants protection chemicals has been substantial. Wide-scale adoption of LCNF would help to reduce the release of harmful chemicals to the air, water and soil. It will minimize the adverse impacts on farmer and consumer health and on biodiversity, reduce cost of cultivation, reduce risks, enhance soil fertility, and protect from uncertainties of climate change.

OBJECTIVE

To evaluate the effect of low cost natural farming in comparison to organic farming and conventional farming on growth, yield and quality of the crops

METHODOLOGY

The investigation was conducted at Instructional Farm, Department of Agronomy, JAU, Junagadh, Gujarat during *rabi* 2019-20. The soil of experimental site was clayey in texture and slightly alkaline in reaction with pH 8.34 and EC 0.54 dS/m. The soil was low in available nitrogen (239.88 kg/ha), medium in available phosphorus (32.14 kg/ha) and medium in available potassium (254.06 kg/ha) during *rabi* 2019-20. The experiment was conducted on non-organic fixed plot with large plot technique and five samples collected from

each of 2.7 m x 4.8 m plot. The present experiment included wheat and chickpea. Module-I included intercropping of wheat and chickpea (4:1 replacement series); Module-II and III included sole cropping of both crops. Variety GW 496 with 22.5 cm spacing, RDF of 120-60-60 kg N-P_2O_5-K_2O/ ha along with 10 t/ha FYM; and variety GG 5 with 45 cm x 10 cm spacing, RDF of 20-40-0 kg N-P_2O_5-K_2O/ha along with 5 t/ha FYM of wheat and chickpea, respectively used for sowing. Whole Package of various treatments of different farming systems presented below.

METHODOLOGY

(1) Module-I: Low Cost Natural Farming (LCNF)

- Intercropping of wheat and chickpea in 4:1 row ratio (replacement series)
- Seed treatment with *Beejamrut* by spraying on wheat and chickpea seed, mix well and dry before sowing
- Soil application of *Ghan Jeevamrut* @ 250 kg/ha along with FYM @ 250 kg/ha at sowing as well assoil application of *Jeevamrut* with irrigation at sowing, 30, 60 & 90 DAS
- *Achhadan*: Wheat straw mulch @ 5 t/ha
- Plant protection: *Agniastra*, *Brahmastra, Neemastra*, *etc.,* if required

(2) Module-II: Organic Farming (OF)

- Sole cropping of wheat and chickpea as per area covered in LCNF
- Seed treatment with *Azotobacter* spp. and *Rhizobium* spp. by spraying on wheat and chickpea, respectively; mix well and dry before sowing
- Soil application of vermicompost @ 2 t/ha, FYM and foliar application of *Panchagavya* at 30, 45 and 60 DAS
- Plant protection: Pheromone trap, *Trichoderma*, *Beauveria*, *Metarhizium*, NPV, *etc*., if required

(3) Module-III: Conventional Farming (CF)

- Sole cropping of wheat and chickpea as per area covered in LCNF
- Seed treated with recommended fungicide like, carbendazim before sowing of seed
- Soil application of chemical fertilizer and manures as per requirement of wheat and chickpea
- Plant protection: Recommended fungicides, insecticides and herbicides, if required

RESULTS AND DISCUSSION

Growth parameters

(A) Wheat

Table 1: Performance of wheat under low cost natural farming, organic farming and conventional farming

Sr. No.	Particular	LCNF	OF	CF	S.Em. ±	C.D. at 5%	C.V. %
1	Plant height at harvest (cm)	74.82	82.95	90.97	1.50	4.63	9.06
2	Dry matter per plant at harvest (g)	16.89	19.50	22.01	0.36	1.11	9.28
3	Number of effective tillers/m row length at harvest	47.35	53.61	58.88	0.91	2.81	8.54
4	Number of spikes/plant	2.31	3.43	4.58	0.06	0.19	9.13
5	Number of spikelets/spike	10.27	12.01	13.45	0.22	0.68	9.31
6	Number of grains/spike	28.54	32.83	36.42	0.56	1.72	8.58
7	Length of spike (cm)	13.40	14.70	15.82	0.27	0.83	9.18
8	1000-grain weight (g)	39.57	43.08	46.59	0.80	2.45	9.23
9	Grain yield (kg/ha)	3123	3983	4930	96	296	11.98
10	Straw yield (kg/ha)	4453	5481	6704	140	433	12.66
11	Protein content (%)	10.57	11.43	12.33	0.17	0.52	7.32

The concerned data on plant height, dry matter per plant and number of effective tillers/m row length at harvest of wheat are presented in Table 1. The concerned data indicated that among the different farming modules, conventional farming recorded significantly the highest plant height (90.97 cm), dry matter per plant (22.01 g) and effective tiller/m row (58.88) as compared to organic and natural farming.

(B) Chickpea

Table 2: Performance of chickpea under low cost natural farming, organic farming and conventional farming

Sr. No.	Particular	LCNF	OF	CF	S.Em.±	C.D. at 5%	C.V. %
1	Plant height at harvest (cm)	41.62	46.84	49.04	0.83	2.57	9.10
2	Dry matter per plant at harvest (g)	27.00	29.97	31.21	0.49	1.51	8.34
3	Number of branches/plant at harvest	5.24	6.16	6.44	0.10	0.30	8.14
4	Number of pods/plant	54.25	60.75	63.37	1.03	3.18	8.69
5	Pod weight/plant (g)	12.23	13.70	14.32	0.24	0.74	8.98
6	100-seed weight (g)	18.75	20.92	21.54	0.33	1.02	8.12
7	Seed yield (kg/ha)	1737	2257	2415	54	166	12.58
8	Stover yield (kg/ha)	2794	3377	3609	86	266	13.26
9	Protein content (%)	18.14	21.38	22.24	0.33	1.00	7.91

An evaluation of the data (Table 2) indicated that different farming modules imparted significant impact on growth of chickpea plant. Significantly higher plant height (49.04 cm), dry matter/plant (31.21 g) and number of braches/ plant (6.44) was recorded with conventionally grown sole chickpea (CF), it was statistically at par to the organic farming (OF) and significantly the lowest growth was recorded under chickpea intercropped with wheat, application of cow based bioenhancers (LCNF).

The improvement in growth parameters with application of 100% RDF through fertilizers along with FYM might have been attributed to better and timely availability of nutrients for their utilization by plant (Chaturvedi *et al*., 2010). Among NPK, nitrogen is considered to be a vitally important nutrient for plant growth as it is an integral part of chlorophyll, which is the primary absorber of light energy required for photosynthesis and protein formation. Phosphorus enhances the various metabolic and physiological processes and thus known as 'energy currency' which is subsequently used for vegetative and reproductive growth through photo-phosphorylation. These finding are corroborating with results of Mere *et al*. (2012), Jat *et al*. (2013), Baskar *et al.* (2017) and Patel *et al.* (2018).

Vermicompost contains higher amount of hormones and balanced soil pH, maintain the favourable environment results in maximum growth of bacteria present in root nodules might be the reason of the maximum number of root nodules and dry weight of nodules per plant in legumes (Sitaram *et al*., 2014). *Panchagavya* is the fermented organic which contains effective microorganisms and methylotrophs profile bacteria (MPB) also. This helps in production of phytohormones. Presence of growth enzymes in *Panchagavya* might have favoured rapid cell division and cell elongation (Patil *et al*., 2012). The above explanation might be the reason for increase in plant growth in legume crops.

Yield attributes and yield

(A) Wheat

An inquisition of the data on yield attributes and yield differed significantly among the different modules (Table 1) revealed that significantly the highest number of spikes/plant (4.58), number of spikelet/spike (13.45), number of grains/spike (36.42), length of spike (15.82), test weight (46.59 g), grain yield (4930 kg/ha) and straw yield (67704 kg/ha) was recorded with application of industrially manufactured chemicals like, urea, DAP and MOP, FYM, fungicides, insecticides and herbicides (CF) over organic farming (OF) and the crop grown under the low cost natural farming (LCNF) recorded the lowest yield attributes and yield.

(B) Chickpea

A glimpse of the data presented in Table 2 revealed that significantly the highest number of pods/plant (63.37), pod weight/plant (14.32 g), seed index (21.54 g), seed yield (2415 kg/ha) and stover yield (3609 kg/ha) was recorded with application of chemical fertilizers, fungicides, insecticides and herbicides (CF), which was statistically at par with the organic farming (OF) and crop grown under the low cost natural farming (LCNF) recorded the lowest yields.

The improvement in growth and yield attributes to chemical fertilizers over only supply of organic manure as nutrient availability is lower as compared to chemical fertilizers and quick release of nitrogen might have helped in vegetative growth of plant and ultimately support to various yield attributes (Patel *et al*., 2019). Combined use of organic and inorganic sources of nutrients could be attributed to better synchrony of nutrient availability (Mwale, 2000),

which was reflected in higher grain yield and biomass production and also the higher nutrient use efficiency. Higher yield of chickpea was might be due to beneficial effect of organic manures which increased the availability of nutrients considerably resulting in improvement of nodule development, energy transformation, metabolic process and root growth causing more dry matter production and number of nodules (Chaturvedi *et al*., 2010). These finding are corroborating with results of Baskar *et al.* (2017), Chaudhary *et al*. (2017), Patel *et al.* (2018), Singh *et al.* (2018), Pradeep *et al*. (2018) and Sikka *et al.* (2018).

Quality parameters

(A) Wheat

It is inferred from the data presented in Table 4.1 and Fig. 5.1(a) that wheat grown with application of industrially manufactured chemicals like, urea, DAP and MOP along with FYM, fungicides, insecticides and herbicides (CF) recorded significantly higher protein content (12.33%), followed by the organically grown sole wheat under application of vermicompost and FYM and *Panchagavya* and bioagents (OF) and significantly the lowest protein content (10.57%) was observed in the low cost natural farming (LCNF).

(B) Chickpea

It is explicit from the data that significantly the highest protein content (22.24%) was reported with the conventional farming system under RDF through urea, DAP and MOP along with application of FYM and pesticides (CF), statistically followed by the organic farming (OF) having protein content of 21.38% and cow based bioenhancers like, *Beejamrut*, *Jeevamrut, Ghan Jeevamrut*, FYM, mulch, *Agniastra*, *Brahmastra* and *Neemastra* (LCNF) recorded significantly the lowest protein content of 18.14%.

In the present experiment, adequate source of nutrients supply under the conventional farming, followed by the organic farming increased quality of crops might be due to increased availability of nutrients timely which in turn accelerated crop growth and there by enhanced the quality (Singh *et. al*., 2018) Higher nitrogen content in seed was observed with the conventional practices and improve photosynthetic and metabolic activity which results in better partitioning of photosynthates to sinks, which reflected in quality enhancement in tern of protein content. The results are in conformity with those reported by Gopinath *et al*. (2008), Mere *et al*. (2012), Jat *et al*. (2013), Singh *et al.* (2018) and Jadhao *et al*. (2019).

CONCLUSION

The experimental result seems quite logical to concluded that conventional farming system that included recommended dose of fertilizers and manures along with chemical control of weeds, insects-pests and diseases significantly increased growth, yield and quality of wheat and chickpea, being at par with organic farming in performance of chickpea on medium black calcareous soil of South Saurashtra Agro-climatic zone.

IMPLICATIONS

(1) The findings of this study would help farmers to distinguish between his existing farming system and current scenario in farming.

(2) This study would help to knowing difference between the natural, organic and conventional farming systems.

ACKNOWLEDGEMENT

The authors are grateful to College of Agriculture, Junagadh Agricultural University, Junagadh for providing necessary field and laboratory facilities during Ph.D. research work.

CONFLICT OF INTEREST

There is no conflict between author.

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Received : May 2022 : Accepted : June 2022