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Research Article

Influence of integrated organic nutrient management practices on quality parameters of chickpea grown in vertisol of northern dry zone of Karnataka

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Abstract : Field trials were conducted on Vertisols at Agricultural Research Station, Annigeri, UAS, Dharwad during *Rabi* season of 2009-2010 and 2010-2011 to study the influence of integrated organic nutrient management practices on quality parameters of chickpea (*Cicer arietinum* L.) grown in vertisol of northern dry zone of Karnataka. Soil application of various organic manures and foliar spray of liquid organic manures at flower initiation and 15 days after flowering (DAF) significantly improved the quality parametes in chickpea. Among the treatment combinations, application of enriched compost (EC) (1/3) + vermicompost (VC) (1/3) + glyricidia leaf manure (GLM) (1/3) equivalent to 100 per cent RDN and foliar spray of panchagavya @ 3 per cent at flower initiation and 15 DAF has recorded significantly, higher protein yeild (499 kg/ha), higher total chlorophyll content in leaves(2.29 mg/g fr. wt. leaves), compared to other treatment combinations.

Key Words : Chickpea, Organic manures, Panchagavya , Vermicompost

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INTRODUCTION

The chickpea (*Cicer arietinum* L.) as a healthy vegetarian food has an important role in human food and domestic animal feed in India. It is a cheap source of high quality in the diets of millions of people in developing countries, who cannot afford animal for balanced nutrition . Also chickpea play a key role in organic cropping systems. In such agro ecosystem with limited availability of nitrogen, chickpea, potentially constitute both a cash crops and a source of N incorporation into the system via biological nitrogen fixation. To be sustainable, organic farming needs to be self-sufficient in nitrogen (N) through the fixation of atmospheric di- nitrogen (N_2) by legumes, recycling of crop residues (green manures) and the application of farmyard manure, compost, green leaf manure, neem cake , organic liquid manures spray and biofertilizer. Phosphorus is present as mineral deposits, which are a non-renewable natural resource. There is global concern about the energy and costs involved in mining the phosphate rock and its transport to manufacturing sites, as well as in the manufacture of different fertilizers and their transport to farm fields and application to the crops. Photosynthesis and stomatal conductance are reduced by P deficiency and, conversely, increases P increased photosynthesis. Phosphate solubilizing bacteria are also known to increase phosphorus uptake resulting in better growth

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and higher yield of crop plants (Rudresh *et al*., 2005). The combined inoculation of *Rhizobium* and phosphate solubilizing bacteria has increased nodulation, growth and yield parameters in chickpea. The study of combining these organisms and organic manures is of great potential value to organic agriculture in order to avoid chemical fertilizers and pesticides. The present research is going to introduce a sustainable soil fertility system, evaluates the influence of integrated organic nutrient management practices on quality parameters of chickpea grown in vertisol.

EXPERIMENTAL METHODS

The soil of the experimental plot was clayey in texture (64.63% clay, 13.12% sand and 22.25% silt) with bulk density of 1.27 g/cc, alkaline in reaction (pH 7.9), low in organic carbon (0.51%), low in available nitrogen (202 kg/ha), and phosphorus (18.90 kg/ha) and medium in available potassium (347 kg/ha). The experiment was laid out in RCBD with three replications. There were 18 treatment combinations consisting of four main factors mainly soil application of four organic manures OM1: Farmyard manure (FYM) (1/3rd) + vermicompost (VC) (1/3rd) + glyricidia leaf manure (GLM) (1/3rd) equi. The experiment was carried out at Agricultural Research Station, Annigeri, UAS, Dharwad, Karnataka valent to 100 per cent RDN, OM_2: EC (1/3rd) + VC (1/3rd) + GLM (1/3rd) equivalent to 100 per cent RDN, OM_3: FYM (1/3rd) + VC (1/3rd) + neem cake (NC) (1/3rd) equivalent to 100 per cent RDN, OM_4: EC (1/3rd) + VC (1/3rd) + NC (1/3rd) equivalent to 100 per cent RDN and sub-factors consisting of foliar spray of four liquid manures mainly LM_1 : panchagavya @ 3 per cent at flower initiation and 15 days after flower initiation (DAF), LM_2 : biodigester @ 10 per cent at flower initiation and 15 DAF, LM_3: cow urine @ 10 per cent at flower initiation and 15 DAF, LM_4 : Vermiwash @ 10 per cent at flower initiation and 15 DAF in addition to two control treatments RDF and absolute control (water spray). The crop was shown on 10-10-2009 and 13- 10- 2010 with a spacing of 30 cm × 10 cm. The recommended dose of nutrients for chickpea were supplemented through different combination of organic manures on nutrient equivalent bases and additional phosphorus was balanced through application of rock phosphate with PSB. The required quantity of organic manures and rock phosphate with PSB as per treatment was incubated for 30 days before sowing of crop under shade with regular watering and were applied at the time of sowing as per the treatments. For RDF treatments, DAP was applied at the time of sowing.

The protein content in seed at harvest was calculated by estimating the nitrogen content as per the modified Kjeldahl's method (Jackson, 1967). The protein content was calculated as follows.Protein (%) = Nitrogen (%) x 6.25

Total chlorophyll, chlorophyll a and chlorophyll b contents were determined following the method of Arnon (1949) at grand growth stage as described below.

The fresh leaves from top of the canopy were brought in an ice box from the field and were cut into small pieces. 200 mg of leaves were weighed from each sample and were homogenized with pure acetone. The extract was filtered through Whatman No. 1 filter paper and washed twice in 80 per cent acetone. The final volume of the extract was made upto 25 ml. The absorbance of the extract was read at 645, 652 and 663 hm in ultra spec double beam spectrophotometer (Model CL-24). Chlorophyll a and chlorophyll b contents were recorded and expressed in mg per g fresh weight.

$$\text{Total chlorophyll} = \frac{(20.2 \times A645) + (8.02 \times A\ 663)}{a \times 1000 \times w} \times V \text{ (mg/g fr. wt.)}$$

$$\text{Chlorophyll 'a'} = 12.7\,(A663) - 2.69\,(A645)\,\frac{25}{1000 \times 0.25} \times V \text{ (mg/g fr. wt.)}$$

$$\text{Chlorophyll 'b'} = 22.9\,(A645) - 4.68\,(A663)\,\frac{25}{1000 \times 0.25} \times V \text{ (mg/g fr. wt.)}$$

where,

A645 : Absorbance of extract at 645 nm ,

A663 : Absorbance of extract at 663 nm a : Path length of light in cuvette (1 cm)

b: Volume of extract (25 ml), w: Fresh weight of the sample (g)

The data collected from the experiment at different growth stages and at harvest were subjected to statistical analysis as described by Gomez and Gomez (1984). The level of significance used for 'F' and 't' test was p = 0.05. Critical difference values were calculated whenever 'F' test was found significant. In case of non-significant effects, value of standard error of means alone is presented in tables.

EXPERIMENTAL RESULTS AND ANALYSIS

The protein content in seed and protein yield are the indication of nutritive quality of chickpea (Table 1). No variation in protein content was found due to the use of organic manures, liquid organic manure and their combinations. But, the protein yield with OM_2 recorded significantly higher protein yield by virtue of higher seed yield inspite of the no variation in protein content significantly higher protein yield (449 kg/ha) with 13 per cent increase over OM_3. Similarly, panchagavya spray recorded significantly higher protein yield (461 kg/ha) indicating 26 per cent increase over LM_2. Among the interactions, OM_2LM_1 recorded significantly higher protein yield (499kg/ha) by virtue of higher seed yield of chickpea. These results are in line with findings of Beaulah (2001) reported that, the quality parameters *viz.,* crude fibers, protein, ascorbic acid, carotene content and shelf life were also higher under

Table 1 : Protein content and protein yield of chickpea as influenced by integrated organic nutrient management practices (Pooled data of 2009-2010 and 2010-2011)

Treatments	Protein content (%)	Protein yield (kg/ha)
Organic manures (OM)		
OM_1 : FYM 1/3rd + VC 1/3rd + GLM 1/3rd equivalent to 100% RDN	21.03	415
OM_2 : EC 1/3rd + VC 1/3rd + GLM 1/3rd equivalent to 100% RDN	20.97	449
OM_3 : FYM 1/3rd + VC 1/3rd + NC 1/3rd equivalent to 100% RDN	20.96	404
OM_4 : EC 1/3rd + VC 1/3rd + NC 1/3rd equivalent to 100% RDN	21.29	425
S.E.±	0.18	11
C.D. (P=0.05)	NS	31
Liquid organic manures (LM)		
LM_1: Panchagavya @ 3 % at flower initiation and 15 DAF	21.08	461
LM_2: Biodigester @ 10% at flower initiation and 15 DAF	21.20	368
LM_3: Cow urine @ 10% at flower initiation and 15 DAF	20.97	444
LM_4: Vermiwash @ 10% at flower initiation and 15 DAF	21.01	421
S.E.±	0.18	11
C.D. (P=0.05)	NS	31
Interaction		
OM_1LM_1	21.08	457
OM_1LM_2	20.68	354
OM_1LM_3	21.24	433
OM_1LM_4	21.11	415
OM_2LM_1	20.87	499
OM_2LM_2	21.30	384
OM_2LM_3	21.07	470
OM_2LM_4	20.65	445
OM_3LM_1	21.12	435
OM_3LM_2	21.30	359
OM_3LM_3	20.70	426
OM_3LM_4	20.73	395
OM_4LM_1	21.23	453
OM_4LM_2	21.52	374
OM_4LM_3	20.88	446
OM_4LM_4	21.54	429
Control		
C_1 – RDF	21.38	385
C_2 – Water spray	20.82	301
S.E.±	0.36	21
C.D. (P=0.05)	NS	59

FYM – Farm yard manure VC – Vermicompost GLM – Glyricidia leaf manure NC – Neem cake
EC – Enriched compost RDN – Recommended dose of nitrogen (25 kg/ha)
RDF – Recommended dose of fertilizer (25:50:0 N:P_2O_5 kg/ha)
DAS – Days after sowing DAF – Days after flower initiation NS = Non-significant

organic manure applied with panchagavya spray in rice. Vasanthi and Subramanian (2004) observed that the highest crude protein N, P and K concentration and uptake were recorded in the treatment that received vermicompost @ 2 t per ha along with 100 per cent recommended levels of N, P and K.

Higher chlorophyll content in the leaves of chickpea is an indication of higher photosynthetic efficacy of the plant. Among organic manures, significantly higher chlorophyll content (Table 2) was recorded with OM_2 (2.19 mg/g fresh weight) over other organic manures except OM_1. Among liquid organic manures, panchagavya spray resulted in significantly higher chlorophyll content over LM_3. Among the interaction effects, OM_2LM_1 recorded significantly higher chlorophyll content (2.29 mg/ g fresh weight) followed by OM_1LM_1, OM_1LM_4, OM_2LM_2 and OM_3LM_4. All the interactions of organic manures and liquid organic manures recorded significantly higher chlorophyll content over water spray and RDF. The *Azospirillum* and coconut water present in

Table 2 : Chlorophyll 'a', chlorophyll 'b' and total chlorophyll content of leaves at grand growth stage of chickpea as influenced by integrated organic nutrient management (Pooled data of 2009-10 and 2010-2011)

Treatments	Chlorophyll 'a' (mg/g fr. wt. leaves)	Chlorophyll 'b' (mg/g fr. wt. leaves)	Total chlorophyll (mg/g fr. wt. leaves)
Organic manures (OM)			
OM_1 : FYM 1/3rd + VC 1/3rd + GLM 1/3rd equivalent to 100% RDN	1.59	0.54	2.13
OM_2 : EC 1/3rd + VC 1/3rd + GLM 1/3rd equivalent to 100% RDN	1.64	0.55	2.19
OM_3 : FYM 1/3rd + VC 1/3rd + NC 1/3rd equivalent to 100% RDN	1.57	0.52	2.10
OM_4 : EC 1/3rd + VC 1/3rd + NC 1/3rd equivalent to 100% RDN	1.58	0.52	2.10
S.E.±	0.02	0.01	0.02
C.D. (P=0.05)	0.05	0.02	0.06
Liquid organic manures (LM)			
LM_1: Panchagavya @ 3 % at flower initiation and 15 DAF	1.63	0.55	2.18
LM_2: Biodigester @ 10% at flower initiation and 15 DAF	1.53	0.51	2.04
LM_3: Cow urine @ 10% at flower initiation and 15 DAF	1.63	0.55	2.18
LM_4: Vermiwash @ 10% at flower initiation and 15 DAF	1.60	0.53	2.13
S.E.±	0.02	0.01	0.02
C.D. (P=0.05)	0.05	0.02	0.06
Interaction			
OM_1LM_1	1.61	0.56	2.17
OM_1LM_2	1.53	0.51	2.05
OM_1LM_3	1.63	0.54	2.17
OM_1LM_4	1.60	0.54	2.14
OM_2LM_1	1.71	0.58	2.29
OM_2LM_2	1.58	0.53	2.10
OM_2LM_3	1.66	0.55	2.21
OM_2LM_4	1.63	0.55	2.18
OM_3LM_1	1.60	0.53	2.13
OM_3LM_2	1.49	0.49	1.98
OM_3LM_3	1.64	0.55	2.19
OM_3LM_4	1.57	0.52	2.09
OM_4LM_1	1.61	0.53	2.14
OM_4LM_2	1.53	0.51	2.04
OM_4LM_3	1.60	0.53	2.13
OM_4LM_4	1.58	0.52	2.10
Control			
C_1 – RDF	1.51	0.50	2.01
C_2 – Water spray	1.40	0.46	1.87
S.E.±	0.03	0.01	0.04
C.D. (P=0.05)	0.09	0.03	0.12

FYM – Farm yard manure VC – Vermicompost GLM – Glyricidia leaf manure
NC – Neem cake EC – Enriched compost RDN – Recommended dose of nitrogen (25 kg/ha)
RDF – Recommended dose of fertilizer (25:50:0 N:P_2O_5 kg/ha)
DAS – Days after sowing DAF – Days after flower initiation NS – Non-significant

panchagavya containing kinetin along with other enzymes might have increased the chlorophyll content of the leaves. Higher chlorophyll content as a result of organic and liquid organic manures and their combination recorded in higher growth and yield attributing characters and thus yield of chickpea. These results are in confirminity with finding of Nekar *et al.* (2009) studied the effect of foliar application of liquid organic manures on growth and productivity of groundnut. Application of panchagavya and cow urine recorded significantly higher SPAD chlorophyll meter reading, test

weight, pod yield and net returns compared to control. Application of FYM @ 15 t ha^{-1} + NPK @ 75:75:50 kg ha^{-1} + 3 per cent panchagavya foliar spray recorded the highest growth parameters, nutrient uptake, yield and andrographolide content followed by FYM @ 15 t ha^{-1}+panchagavya @ 3 per cent foliar spray recorded the next best yield in Kalmegh (Sanjutha *et al.*, 2008).

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