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RESEARCH ARTICLE

Effect of integrated nutrient management on protein content of lentil seeds under rainfed condition

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SUMMARY

A field experiment was conducted on clay loam soil at RAK college of Agriculture ,Sehore, MP during *Rabi* season 2009-10 and 2010-11 to evaluate the response of integrated nutrient management on protein content in seeds of lentil (*Lens culinaris* Medik) under rainfed condition.The experiment was conducted in the Randomized Complete Block Design with three replications and 14 treatments; *i.e.*, treatments consisted of (T_1) control, (T_2) NPKS (20:17:20:20 kg/ha), (T_3) 50% NPKS, (T_4) FYM @ 5 t/ha, (T_5) vermicompost @ 2 t/ha, (T_6) NPKS (20:17:20:20 kg/ha) + FYM @ 5t/ha, (T_7) NPKS (20:17:20:20 kg/ha) + vermicompost @ 2 t/ha, (T_8) 50% NPKS +FYM @ 5 t/ha, (T_9) 50% NPKS + vermicompost @ 2 t/ha, (T_{10}) *Rhizobium* culture +PSB, (T_{11}) NPKS (20:17 : 20:20 kg/ha) + *Rhizobium* culture + PSB, (T_{12}) 50% NPKS +*Rhizobium* culture + PSB, (T_{13}) FYM @ 5 t/ha + *Rhizobium* culture + PSB and (T_{14}) vermicompost @ 2 t/ha + *Rhizobium* culture +PSB were tested. Protein content in seeds was observed significantly higher with the application of (T_7) NPKS (20:17:20:20 kg/ha) +vermicompost @ 2 t/ha. Hence, application of treatment (T_7) NPKS (20:17:20:20 kg/ha) +vermicompost @ 2 t/ha resulted in the highest protein content as compared to control and other treatments.

Key Words : Biofertilizers, INM, NPKS, Protein content, Rainfed conditions

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In India lentil occupies an area of 1.40 m/ha and produced 1.03 m tones of grains with an average productivity of 741 kg/ha (Deol *et al*., 2005), cultivated lentil belongs to two broad group, the small seeded and large seeded. The large seeded varieties of lentil are comparatively found to be more mutable than the small seeded varieties (Solanki and Sharma, 2002). Lentil belongs to the family Fabaceae. Lentil is an important pulse crop of Indian subcontinent. The diploid chromosome number is $2n = 2x = 14$. Lentil (*Lens culinaris* Medik.) contains 28.6% proteins, 3.1%ash, 4.6% crude fibres, 44.3% starch, 36.1% amylase, 63.1% total carbohydrates and 420 cal. 100/g gross energy. Cooking quality generally depends on the varieties fertility status of the soil and seed maturity of the crop seed (Shah *et al*., 2000).This crop is valued as a high protein source residues are used for animal feedings (Mishra *et al*., 2001). Lentil (*Lens culinaris* Medik.) is one of the most important legume crops in rainfed cropping systems and it is tolerant crop to drought, and are commonly grown in the world (Sarker *et al.*, 2003). As the average of the last five years, production of lentils is more than 3 million tones and the most important producers are Canada, India, Turkey and the United States (FAO, 2009). There are protein-calorie malnutrition problems in Turkey as all over the world. Legumes may be helpful in solving this problem (Karadavut and Genç, 2010). Having high level protein including essential amino acids such as isoleucine, methionine, cysteine and lysine, lentil has a great importance in terms of both human nutrition and health; it is source of cheap protein in the world (Isik *et al.*, 2011).

Rainfed farming is the practice of growing crops, entirely depending on rainfall as source of moisture where the mean

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annual rainfall is around 750 mm. The quantity of rainfall should be adequate/sufficient to meet the crop demand. Chemical fertilizers alone can not sustain productivity of land under modern farming. Similarly, nutrient supply through organic manures or biofertiliazers can hardly fulfil the need of a crop. Application of organic manure in conjunction with inorganic fertilizer in an integrated manner, appears to be the best alternative. Integrating chemical fertilizer with organic manures has been found to be quite promising not only in maintaining higher productivity but also in providing great stability in crop production (Nambiar and Abrol, 1989) . Farm yard manure or vermicompost when integrated with reduced doses of inorganic fertilizers result in improved soil fertility, growth and yield of plant (Subbian, and Palaniappan, 1992). Chemical fertilizers have deleterious effect on soil fertility leading to unsustainable yields; while integratetion of chemical fertilizers with organic manures and bio-fertilizers would be able to maintain soil fertility and sustain crop productivity (Jeyabal *et al.,* 2000).Nutrient supply plays an important role in the crop production but under intensive cultivation use of chemical fertilizers alone for long period could result in deterioration of soil fertility and quality of produce. The use of organic manure in combination with inorganic fertilizers has been recommended for balancing soil fertility by several workers. In view of better quality, higher demand lentil grown by adopting INM as evident from the above cited literature, the present study was carried out to find out the response of integrated nutrient management on protein content of lentil seeds under rainfed condition.

MATERIAL AND METHODS

The experiment was conducted in Randomized Complete Block Design with 14 treatments using chemical fertilizers, farm yard manure, vermicompost and biofertilizers (*Rhizobium* and phosphate soluble bacteria) in different combinations including one control treatment at RAK college of Agriculture, Sehore during *Rabi* season 2009-10 and 2010-11 to evaluate the response of integrated nutrient management on protein content (%) in seeds of lentil. Fourteen treatments were consist of control (T_1), (T_2) NPKS (20:17:20:20 kg/ha), (T_3) 50% NPKS, (T_4) FYM @ 5 t/ha, (T_5) vermicompost @ 2 t/ha, (T_6) NPKS (20:17:20:20 kg/ha) + FYM @ 5t/ha, (T_7) NPKS (20:17:20:20 kg/ha) + vermicompost @ 2 t/ha, (T8) 50% NPKS +FYM @ 5 t/ha, (T_9) 50% NPKS + vermicompost @ 2 t/ha, (T_{10}) *Rhizobium* culture +PSB, (T_{11}) NPKS (20:17:20:20 kg/ha) + *Rhizobium* culture + PSB, (T_{12}) 50% NPKS +*Rhizobium* culture + PSB, (T_{13}) FYM @ 5 t/ha + *Rhizobium* culture + PSB and (T_{14}) vermicompost @ 2 t/ha + *Rhizobium* culture +PSB. Lentil variety JL-3 was selected for this investigation. The average rainfall of last ten year has been 995.05 mm and its range from 588.4 to 1329.5 mm. The mean annual maximum and minimum temperature are 29.09^{0}C and 12.74^{0}C, respectively. the maximum and minimum temperature during crop season, ranged from 37.36^{0}C to 22.33^{0}C and 19.43^{0}C to 4.90^{0}C (2009-10) and 36.35^{0}C to 21.42^{0}C and 17.78^{0}C to 7.78^0 (2010-11), respectively, while maximum and minimum relative humidity was recorded 95.71 and 42.00 (2009-10) and 70.85 and 63.14 (2010-11) per cent, respectively. The soil of the experimental field was clay loam and before sowing soil N, P, K, pH and EC was 200kg/ha,15.00kg/ha,440kg/ha,7.5 and 0.3 ds/m, respectively. In present investigation protein content (%) in seed was estimated by microkjeldahl method (Mishra 1968) by using the formula:

Protein % = Nitrogen % × 6.25

Table 1 : Effect of nutrient management on protein content of seeds in lentil

Treatments		Protein content (%) in seed	
		2009-10	2010-11
Control (no fertilizers)	T_1	21.77	20.50
NPKS (20:17:20:20 kg/ha)	T_2	23.88	22.78
50% NPKS	T_3	23.49	22.51
FYM @ 5 t/ha	T_4	23.43	22.00
VC @ 2 t/ha	T_5	23.67	22.52
NPKS (20:17:20:20 kg/ha) + FYM @ 5 t/ha	T_6	25.13	23.93
NPKS (20:17:20:20 kg/ha) + VC @ 2 t/ha	T_7	25.34	24.27
50% NPKS + FYM @ 5 t/ha	T_8	24.47	23.32
50% NPKS + VC @ 2 t/ha	T_9	24.71	23.58
RZ culture + PSB	T_{10}	23.40	21.95
NPKS (20:17:20:20 kg/ha) + *RZ* culture + PSB	T_{11}	24.42	23.30
50% NPKS + *RZ* culture + PSB	T_{12}	24.02	22.95
FYM @ 5 t/ha + *RZ* culture + PSB	T_{13}	23.72	22.62
VC @ 2 t/ha + *RZ* culture + PSB	T_{14}	23.78	22.65
S.E. ±		0.43	0.33
C.D. (P=0.05)		1.24	0.97

Data were statistically analyzed by procedure described by Fisher (1958).

RESULTS AND DISCUSSION

The protein content in seed was significantly influenced by various integrated nutrient management treatments. Protein content in seeds were found maximum in treatment T_7 (NPKS 20:17:20:20 kg/ha + vermicompost @2t/ha) due to higher nitrogen content in seeds brought about by increased nitrogen availability through organic and inorganic fertilizers application followed by in T_6 treatment during both the year of experimentation (Table 1). The similar results were reported by Dubey *et al.* (2012) in fenugreek. Application of 50% NPKS + vermicompost @ 2t/ha and 50% NPKS + FYM@ 5t/ha. recorded protein content in seed significantly superior over control and other treatments. It is very clear that addition of organic manure in the form of FYM or vermicompost may be helpful in increasing protein content in seeds. The results are in conformity with those of Maheshbabu *et al*. (2008) in soyabean.

Conclusion:

Application of NPKS (20:17:20:20 kg/ha) along with vermicompost (@2t/ha) resulted in highest protein content in lentil seeds. Organic nutrient in combination with fertilizers increased protein content in lentil seeds due to nitrogen, because nitrogen is a basic constituent of protein. Organic manure and fertilizers increased nitrogen availability and nitrogen use efficiency thereby increasing protein synthesis. Hence, integrated use of chemical fertilizers along with vermicompost had positive effects on quality and quantity of protein content in lentil seeds under rainfed condition.

Abbreviations:

CD-Critical difference, FYM- Farmyard manure, INM-Integrated Nutrient Management, NPKS- Nitrogen Phosphorous Potassium Sulphur, S.E.m- Square Error Mean, PSB- Phosphate Soluble Bacteria, Rz- *Rhizobium*, VC-Vermicompost

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