Annals of Arid Zone 54(1&2): 39-41, 2015

On Farm Assessment of Balanced Nutrient Management in Hybrid Chilli for Enhancing Productivity under Sub-humid Conditions

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Abstract: An on-farm trial was conducted for two consecutive years 2013 and 2014 in *Zaid* on hybrid chilli for assessment of balanced nutrient management for enhancing productivity under sub-humid conditions of Banswara district of Rajasthan with three treatments comprising farmer's practice, recommended doses of fertilizers and balanced nutrient management. The chilli yield was highest with application of balanced nutrient management, which was to the tune of 36.6 and 82.7% higher than recommended doses of fertilizers and farmer's practice of nutrient management, respectively. The B:C ratio was also higher (4.78) with balanced nutrient management as compared to 2.52 with farmer's practice.

Key words: Balanced nutrient management, hybrid chilli, B:C ratio.

Chilli or the hot pepper (*Capsicum annuum* L.) is an important spice and vegetable crop valued for its aroma, taste, flavour and pungency. It is widely cultivated throughout warm temperate, tropical and subtropical countries. In India chilli has become almost an essential article of diet of rich and poor. The total production of chilli in the world is estimated at about 25 lakh tones. At present, India is largest producer of chilli in the world (about 13.04 lakh tons). The world consumption of chilli is going up due to the increasing popularity of ethnic foods. The increased availability of oleoresins and spice oils of chilli has also enhanced its consumption in various food preparations.

Among Indian States, Andhra Pradesh is the leading state having highest area, production and productivity of chilli. Karnataka and Maharashtra ranked second and third in area and production of chilli, respectively. In Rajasthan chilli is growing in 12.21 thousand hectares with production of 17.71 thousand Mt So, there is a lot of scope of increasing the area as well as productivity of chilli in Rajasthan (Indian Horticulture Database, 2013). There is a need to exploit the possibility of increasing seed yield of chilli through balanced nutrient management. Better growth and yield of chilli was observed with 100% nutrient dose (Anitha and Geethakumari, 2006).

Sub-humid agro-climatic condition in Banswara district make it possible to grow a wide variety of vegetable crops all the year round specially hybrid chilli. However, their average yield is very low due to intensive cultivation practices, growing of exhaustive crops, use of unbalanced and in adequate fertilizers accompanied by restricted use of organic manures. As a result soils become deficient in nutrients and hence the soil health is deteriorating in the region. Studies have revealed that continuous use of sub-optimal doses of nutrients in an unbalanced proportion led to severe depletion of nutrient reserves in Indian soils, causing multiple nutrient deficiencies and decline in crop productivity (Mahajan and Gupta, 2009). Under such a situation, balanced nutrient management has assumed a great importance and has vital role in the enhancing of soil *vis-à-vis* crop productivity. Therefore, keeping these points in view, the present investigation was under taken to assess the effect of balanced nutrient management in hybrid chilli for enhanced production on vertisol and to convince the farmers for adoption of balanced nutrient management practice to enhance the productivity of chilli at their farms.

Materials and Methods

On-farm trial was carried out for two consecutive years 2013 and 2014 in *Zaid* season in village Sangrampura in Bagidora block of Banswara district of Rajasthan which comes under the southern sub-humid plain zone IV B of Rajasthan. The experimental soil was clay loam and analyzed: pH (1:2.5) 7.20, EC (1:2.5) 0.57 dS m^{-1}, organic carbon 0.54%, available phosphorus (P_2O_5) 26.6 kg ha^{-1} and available

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potassium (K_2O) 254.6 kg ha^{-1}. The chilli hybrid Ujala was grown as a test crop. Five week old seedlings of chilli were transplanted in second fortnight of March in both the years at all the farmer's field. Three treatments viz., T_1-farmer's practice of nutrient management (110:40:0 kg N, P_2O_5, K_2O and use of unfixed (10-25 Mt) quantity of FYM ha^{-1}), T_2-recommended doses of fertilizers (70:48:50 kg N, P_2O_5, K_2O and 20 Mt FYM ha^{-1}) and T_3-balanced nutrient management (200:100:100 kg N, P_2O_5, K_2O with 15 Mt FYM ha^{-1}) were tested in an un-replicated manner and five farmers were used as replicates accommodating all the three treatments. In the treatment with farmer's practice, whole amount of P was applied as basal and nitrogen in two splits half at transplanting and remaining half at 25 days after transplanting. In case of the treatment recommended doses of fertilizers (RDF), entire amount of phosphorus and potassium were applied as basal and nitrogen in three splits, half at transplanting, 25% at 30 days after transplanting and remaining 25% at 45 days after transplanting. While, in the treatment balanced nutrient management whole amount of phosphorus and potassium were applied as basal and nitrogen in four equal splits, 25% at transplanting, 25% at 20 days after transplanting, 25% at flowering stage and 25% after I^{st} picking. Fertilizers used were urea, single super phosphate and muriate of potash, in all the treatments. The rainfall received during 2013 and 2014 was 989 mm and 693 mm, respectively. Soil samples collected after harvest of crop were air dried, ground, passed through a 2 mm sieve and analysed for pH, EC, organic carbon, available phosphorus and potassium contents using standard procedures (Jackson, 1967). Based on the price of cash inputs used and produce (green chilli) obtained during the year (2013 and 14) benefit cost ratio was worked out.

Results and Discussion

The yield attributes and yield of hybrid chilli was influenced by the balanced nutrient management treatment in both the years. The yield attributes i.e. plant height at harvest and number of secondary branches/plant at harvest was recorded maximum with balanced nutrient management treatment. The per cent increase in plant height and number of secondary branches were 12.52, 21.26 and 7.04, 13.30, respectively over RDF and farmer's practice of nutrient management. The yield increased from 123.3 to 166.6 q ha^{-1} in 2013 and 98.2 to 136 q ha^{-1} in 2014 with application of recommended doses of fertilizers (Table 1) over farmer's practice of nutrient management. The increase in yield was in the order of 35.12% in 2013 and 38.49% in 2014. Use of balanced nutrient management increases the yield with tune of 218 q ha^{-1} in 2013 and 186.7 q ha^{-1} in 2014 which were 30.85 and 37.28% higher than application of recommended doses of fertilizers in both the years. Application of required quantity of nutrients is an effective proposition for getting higher yield. These results are in close conformity with earlier findings of Vanlauwe *et al.,* 2002 and Anitha and Geethakumari, 2006. The B:C ratio was also higher 4.78 with balanced nutrient management as compared to 2.52 with farmer's practice of nutrient management.

Nutrient build up

Organic carbon content in the soil increased in the plots that had received soil test based balanced nutrient management than in the plot that had received both recommended doses of fertilizers application and farmer's practice of nutrient management (Table 2). Application of soil test based balanced nutrient management (T_3) increased the organic carbon content over

Table 1. Effect of balanced nutrient management on yield attributes, yield and net profit of hybrid chilli in farmer's field

Treatment	Yield attributes		Yield (q ha^{-1})			Net return (Rs. ha^{-1})	B:C ratio
	Plant height at harvest (cm)	No. of secondary branches/ plant at harvest	2013	2014	Average		
T_1 - Farmer's practice	54.1	18.8	123.3	98.2	110.75	1,58,600	2.52
T_2 - Recommended doses of fertilizers	58.3	19.9	166.6	136.0	151.30	2,33,900	3.40
T_3 - Balanced nutrient management	65.6	21.3	218.0	186.7	202.35	3,34,650	4.78

Table 2. Effect of balanced nutrient management on available nutrient status after harvest of chilli crop

Treatment	Fertility status of soil after 2 years		
	Organic carbon (%)	Available P (P_2O_5 kg ha^{-1})	Available K (K_2O kg ha^{-1})
T_1 - Farmer's practice	0.42	23.10	239.00
T_2 - Recommended doses of fertilizers	0.51	24.00	245.00
T_3 - Balanced nutrient management	0.63	28.40	271.30
	Pre-experimental fertility status		
	0.54	26.60	254.60

RDF treated plots (T_2) and farmer's practice of nutrient management (T_1) by 23.52 and 50.00%, respectively. The increase in organic carbon content may be attributed to addition of organic material with balanced chemical fertilizers and better root growth. These results are in close conformity with the findings of Sharma *et al.* (2005). The post harvest organic carbon content of soil was reduced under treatments (T_1 and T_2) receiving the farmer's practice of nutrient management and recommended doses of fertilizers and it was low when compared with initial values in the experimental soil. This might be due to the uptake of nutrients from the soil by crop. These results get support from earlier results of Venkatakrishnan and Ravichandran (2012).

Available phosphorus and potassium content of soil (Table 2) increased with soil test based balanced nutrient management treatment as compared to RDF treated plots (T_2) and farmer's practice of nutrient management (T_1). The increase in available phosphorus content of soil might be due to the incorporation of organic manures and P fertilizers may be attributed to the direct addition of P as well as solubilization of native P through release of various organic acids. The beneficial effects of balanced nutrient management on available potassium may be ascribed to the reduction of K fixation, solubilization and release of K due to the interaction of organic matter with clay, besides the direct potassium addition to the potassium pool of the soil (Tandon, 1987).

Conclusion

On the basis of results of this on farm trial it can be concluded that soil test based balanced nutrient management should be adopted in order to improve soil fertility and for enhancing productivity of hybrid chilli in farmer's field.

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