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Effect of Nutrient Management Practices and Organic Amendments on Growth, Earliness and Quality of Chilli Hybrid Sitara

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Abstract Experiment was conducted in Dharwad district, Karnataka during *kharif* season of 2015-2016, with an objective to assess the effectiveness of nutrient management practices and organic amendments on growth, earliness and quality of chilli (*Capsicum annuum* L.) hybrid Sitara. The results revealed that the maximum plant height (80.4 cm), branches per plant (6.1), stem thickness (1.6 cm), leaf area index (0.25), days to first flowering (37.6) and days to 50% flowering (37.6) were recorded due to adoption of INM practices. However, with regard to quality parameters like vitamin C (263.6 mg/100 g) and chlorophyll content (2.1 mg/100 g), which were recorded higher with organic practices (among nutrient management practices). Panchagavya application recorded maximum growth and earliness parameters like plant height (82.8 cm), branches per plant (6.5), stem thickness (1.7 cm), leaf area index (0.25), days to first flowering (37.2) and days to 50% flowering (46.7), across different organic amendments. Quality parameters like vitamin C (263.6 mg/100 g) and chlorophyll content (2.1 mg/100 g) also showed best result with panchagavya application. Application of organic manures and organic amendments resulted in high quality chilli fruits over other treatments. Nevertheless, a significant increase in yield of chilli was recorded with the combined application of manures and organic amendments.

Keywords Chilli, INM, Panchagavya, Organic practice.

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Introduction

Chilli (*Capsicum annuum* L.) belongs to the family Solanaceae is one of the most important vegetable cum spice crop grown throughout the world for supply in the fresh market as well as for processing. Chilli is a rich source of vitamin C and its content is 5 times more than that of tomato. The hotness or pungency of chillies is due to presence of capsaicin and dihydrocapsaicin. A large number of constraints limit the production of chilli which include low yielding ability of genetic material, imbalanced supply of nutrients, pest and diseases (leaf curl or murda complex spread by thrips and mites) there is need to optimize these production factors for better quality and yield in chilli.

The technologies in the above mentioned aspects especially low cost ones need to be developed so that such technologies are easily accepted and

Table 1. Effect of nutrient management practices and organic amendments on the growth and earliness parameters of chilli hybrid Sitara.

Parameters	Plant height	Primary branches	Secondary branches	Stem thickness	Leaf area index	Days to first flowering	Days to 50% flowering
Factor I : Nutrient management practices							
M_1	78.6	5.6	11.3	1.3	0.21	38.7	48.2
M_2	80.4	6.1	12.2	1.6	0.25	37.6	47.1
M_3	79.7	5.7	11.5	1.4	0.22	39.3	48.9
SEm±	0.44	0.096	0.19	0.038	0.0023	0.20	0.22
CD at 5%	1.29	0.28	0.56	0.11	0.0068	0.61	0.67
Factor II : Organic amendments							
S_1	82.8	6.5	13.0	1.7	0.25	37.2	46.7
S_2	79.7	5.5	11.0	1.3	0.22	39.0	48.7
S_3	81.3	6.0	11.9	1.5	0.24	38.1	47.7
S_4	74.5	5.3	10.6	1.1	0.21	39.9	49.2
SEm±	0.50	0.11	0.22	0.044	0.0026	0.24	0.26
CD at 5%	1.49	0.32	0.65	0.13	0.0078	0.70	0.77
Interaction	NS	NS	NS	NS	NS	NS	NS

adopted by the farming community. Chilli is grown with all modern agricultural practices, which include chemical fertilizers and pesticides. Because of continuous use of chemicals in chilli, the crop has been highly vulnerable to large of pest and diseases, several sucking pests like mites and thrips have made existence of chilli crop more prone for failure. In view of these problems research priority will regard to nutrient management need to be changed.

The integrated nutrient management paves the way to overcome these problems, which involves conjunctive use of chemical fertilizers, organic manures and biofertilizers to sustain crop production as well as maintenance of soil health. Systematic approach to nutrient management by tapping all possible sources of organic and inorganic in a judicious manner to maintain soil fertility and crop productivity is the essence of integrated nutrient management (INM) (Maruthi et al. 2014). The present study was planned with hypothesis, chemical fertilizer alone will not be able to sustain the productivity, integrated use of all potential sources of plant nutrients seems to be the only option to maintain soil fertility and crop productivity (Kondapanaidu et al. 2009). Chilli being a heavy feeder and exhaustive crop responds very well to nutrient application (Samsangheile and Kanaujia 2014). Keeping above points in mind present study was taken to study the effect of different nutrient management practices and organic amendments on the growth, earliness and quality traits of chilli.

Materials and Methods

A field experiment was conducted during *kharif* season of 2015-16 at farmer field, Neeralakatti village, Dharwad district. The experiment was laid out in randomized block design with factorial concept, replicated thrice. There were 12 treatment combinations with two factors comprising of nutrient management practices and organic amendments. The treatment details are as follows.

Factor I : Nutrient management practices namely, M_1–Organic practice, M_2–INM practices (50% organic + 50% inorganic), M_3–Inorganic practice.

Factor II : Organic amendments namely, S_1–Panchagavya spray @ 3% + *Verticillium luccani* @ 5% at 30 and 60 DAT, S_2–Cow urine spray @ 10% + *Verticillium luccani* @ 5% at 30 and 60 DAT, S_3–Jeevamrutha spray as it is + *Verticillium luccani* @

Table 2. Effect of nutrient management practices and organic amendments on the quality parameters of chilli hybrid Sitara.

Nutrient management practices	Organic amendments									
	Ascorbic acid (mg/100g)					Total chlorophyll (mg/100g)				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
M_1	237.8	186.3	201.3	150.2	193.9	2.1	2.0	2.1	1.6	1.9
M_2	263.6	145.6	151.1	128.9	172.3	1.7	1.3	1.6	1.3	1.5
M_3	199.8	151.2	163.3	142.1	164.1	1.5	1.1	1.3	1.0	1.2
Mean	233.7	161.1	171.9	140.4	176.8	1.8	1.5	1.7	1.3	1.5
For comparing means of		SEm±		CD at 5%		SEm±		CD at 5%		
Nutrients		0.90		2.66		0.012		0.036		
Amendments		1.04		3.07		0.014		0.042		
M × S		1.81		5.32		0.024		0.073		

5% at 30 and 60 DAT, S_4–Control (water spray).

The soil of experimental site comprised of red soil, the crop was raised with spacing of 90 × 60 cm. Standard cultural practices of University of Horticultural Sciences, Bagalkot for chilli crop was followed uniformly for all the experimental plots. According to the treatment need manures and fertilizers were incorporated. Panchagavya and jeevamrutha were prepared according the guidelines of State Department of Horticulture, Karnataka. Leaf area index was recorded using graph method and for ascorbic acid content determination 2, 6-dichlorophenol visual method (Thimmaiah 1999) was used.

Results and Discussion

Growth parameters

The data on growth traits are presented in Table 1. The results revealed that, among nutrient management practices, maximum plant height (80.4 cm), number of primary branches (6.1) and secondary branches (12.2), stem thickness (1.6 cm) and leaf area index (0.25) were recorded in INM practice (M_2). This was followed by inorganic practice (M_3). The lowest plant height (78.6 cm), number of primary branches (5.6) and secondary branches (11.3), stem thickness (1.3 cm) and leaf area index (0.21) were recorded in organic practice (M_1). The increase in vegetative growth might be due to the role of nitrogen in promoting vegetative growth, the added FYM in integrated nutrient management would have improved the physical, chemical and biological properties of soil which helps in better nutrient absorption and utilization by plant resulting better plant growth. Hangarge et al. (2001) reported that maximum growth characters in chilli were recorded under integrated nutrient supply system. These results are in conformity with the findings of Vimera et al. (2012) in king chilli, Samsangheile and Kanaujia (2014) and Vikash Kumar et al. (2016) who found maximum growth characters with INM practices. Mridubhashini et al. (2014) also reported that, the possible cause for improved growth under conjunctive use of nutrients might be due to increased availability of nitrogen to plants initially through inorganic fertilizers and later by organic manures. Gajendra et al. (2015) proved that the combined application of inorganic and organics manure significantly influenced these growth parameters. Yadav and Prajapat (2015) also reproted that INM practices have good effect on growth parameters of okra.

Among different organic amendments used, the panchagavya spray @ 3% + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_1) recorded maximum plant height (82.8 cm), number of primary branches (6.5) and secondary branches (13.0), stem thickness (1.7 cm) and leaf area index (0.25). This was followed by jeevamrutha spray as it is + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_3). The lowest plant height (74.5 cm), number of primary branches (5.3) and secondary branches (10.6), stem thickness (1.1 cm) and

leaf area index (0.21) were recorded in S_4. Control (water spray). The results are in conformity with the findings of Shwetha and Babalad (2008), Nileema and Sreenivasa (2011), Monika Rana et al. (2015) and Ponnumani and Semmalar (2015), that panchagavya application showed higher growth parameters compared to other treatments.

Interaction effect of nutrient management practices and organic amendments did not show significant results with respect to all the growth parameters.

Earliness parameters

The number of days to first flowering and days to 50% flowering differed significantly due to nutrient management practices and application of organic amendments but did not showed significant results with respect to interaction of both.

The data on earliness traits are presented in Table 1. The recorded two earliness parameters showed the same trend of results. Among nutrient management practices, the minimum number of days for both days to first flowering (37.6) and days to 50% flowering (47.1) was observed in INM practices (M_2) which was followed by organic practice (M_1). Maximum days took for both days to first flowering (39.3) and days to 50% flowering (48.9) in inorganic practice (M_3). These results corroborate the findings of Surya Kumari et al. (2009). They stated that, integrated use of vermicompost and chemical fertilizers took minimum days to 50% flowering.Further, findings of Deshpande et al. (2010) and Vikash Kumar et al. (2016) were in conformity with the results of our present study.

The days to first ad 50% flowering was significantly influenced by the different organic amendments too. Application of panchagavya spray @ 3% + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_1) imparts beneficial effect as manifested in minimum days to first (37.2) and 50% flowering (46.7), which was followed by jeevamrutha spray + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_3). Chilli took maximum number of days to first (39.9) and 50% flowering (49.2) when it was subjected to water spray (S_4). Similarly, Somasundaram and Singaram (2006) also reported that the panchagavya had higher content of P and K compared to other amendments and these elemental nutrients presents in panchagavya helps in earlier flowering.

Quality parameters

The quality parameters differed significantly due to different nutrient management practices, application of organic amendments and their interaction effects (Table 2). Chilli grown with organic nutrient practice (M_1) proved to have a significantly higher ascorbic acid (193.9 mg/100g) and chlorophyll content (1.9 mg/100g) in fruits, which was followed by INM practice. The inorganic practice (M_3) showed the lowest ascorbic acid (164.1 mg/100g) and chlorophyll content (1.2 mg/100g). Present results are in similarity with the findings of Pither and Hall (1990) and Nanthakumar and Veeragavatham (2001). They reported significantly higher ascorbic acid content with the application of organics. Naveen et al. (2009), while working with nutritional aspect and quality of green chilli reported higher ascorbic acid, capsaicin, oleoresin when chilli was supplemented with 100% organic manure.

Among organic amendments, panchagavya spray @ 3% + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_1) recorded significantly higher ascorbic acid (233.7 mg/100g) and chlorophyll (1.8 mg/100g) content across different nutrient management practices, which was followed by jeevamrutha spray + *Verticillium luccani* @ 5% at 30 and 60 DAT (S_1). However, the lowest ascorbic acid (140.4 mg/100g) and chlorophyll content (1.3 mg/100g) was recorded with chilli plants which were sprayed with water (S_4), Sreenivasa et al. (2010) also reported that the foliar application of panchagavya @ 3% at the time of flowering recorded higher ascorbic acid and capsaicin content in chilli fruits.

Among interaction effects, M_2S_1 (263.6 mg/100g) showed higher ascorbic acid content which was fol-

lowed by M_1S_1 (237.8 mg/100g), M_1S_3 (201.3 mg/100g) and M_3S_1 (199.8 mg/100g). The lowest ascorbic acid content was recorded due to M_3S_4 (142.1 mg/100g).

The higher (2.1 mg/100g) chlorophyll content was observed with M_1S_1 and M_1S_3 interaction. Which were followed by M_1S_2 (2.0 mg/100g) and M_2S_1 (1.7 mg/100g). The lowest chlorophyll content was recorded due to interaction of M_3S_4 (1.0 mg/100g).

The increase in quality attributes might be ascribed to better availability and uptake of plant nutrients and also favorable conditions resulted by the applied FYM, which is known to help in the synthesis of chlorophyll and increased ascorbic acid content. This is quite evident from the study of Kaminwar and Rajagopal (1993). Increase ascorbic acid content due to application of FYM or organic manures in Paprika was also reported by Petkov (1964).

Conclusion

It can be concluded from the results that the integrated use of 50% inorganics + 50% organics (INM) was found optimum for growth and earliness and organic manuring was best for quality traits. Panchagavya spray has significant effect on growth, earliness and quality traits followed by jeevamrutha spray.

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