

Original Research Article

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Response of Chilli (*Capsicum annum L.*) to Different Sources and Combination of Nitrogen

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ABSTRACT

Keywords

Chilli, Flowering, Growth, Nitrogen, Quality and yield.

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To identify the best source of nitrogen among organic and inorganic sources and their combinations for better growth, flowering behaviour and fruit yield of chilli cv. Bulet, an experiment was conducted in Gangetic Alluvial plain of West Bengal. Six organic manures in different combinations were applied along with Urea at three levels (25%, 50%, and 75%). Result showed that plant height and number of branches per plant was found maximum with a combination of vermicompost and urea at 50%. Flowering was delayed with increase in inorganic nitrogen level (25, 50 and 75%) in the growing media. The yield attributes including fruit yield was found maximum also with nitrogen received from vermicompost and urea at 50% level. However, all the treatments showed the enhanced results over control (with no nitrogen). The qualitative aspects were increased with the application of neem cake compared to other inorganic sources.

Introduction

Among the spice crops of India Chilli (*Capsicum annum L.*), a member of Solanaceae family is an important one. Being introduced by Portuguese in 17th century, now the crop is grown all over India, especially in Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra, account for 3/4 of the total area besides Madhya Pradesh, West Bengal, Punjab, Bihar and Rajasthan (Khan and Pariari, 2012), Dried fruits are used to make universal curry powder and curry paste. The fruit of chilli contains carbohydrates, vitamin A and vitamin C. Fresh green and ripe chillies are used to make all kinds of pickles, different sauces and paste. The red colour, capsanthin is used in high quality cosmetic preparations like

lipstick. The essential oil, oleoresin is used in the food and beverage industries. The pungency is due to an active principle "Capsaicin" an alkaloid present in pericarp and placenta, which are a digestive stimulant and an important ingredient of daily diet and a cure for many rheumatic problems (Chandini Raj *et al.*, 2016). Nitrogen (N) is a major constituent of several of the most important substances which occur in plants. It is of outstanding importance among the essential elements in the N compounds comprises from 40 to 50% of the dry matter of the protoplasm, the living substance of plant cells (Togun *et al.*, 2003). Nitrogen is known to promote production, partitioning and accumulation of dry matter in crop plant

(Akanbi *et al.*, 2007). Tumbare *et al.*, (2004) reported that N-fertilizers increased fruit weight, yield and fruit number of chilli peppers. Improved nitrogen management can be achieved by matching nitrogen supply with crop need and selecting appropriate nitrogen level to minimize nitrate nitrogen accumulation in soil at times, when the leaching potential is high (Papendick, 1987). However, information regarding the response of chilli to different sources and combination of nitrogen in alluvial plains of West Bengal is meager. Hence, the present study was conducted to determine the effect of different nitrogen source on growth, reproductive behaviour and quality of chilli.

Materials and Methods

Experimental site

The present investigation was carried out at Horticultural Research Station, Mondouri, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, and West Bengal in consecutive two seasons during 2013-14 and 2014-15 in chilli cv. Bulet in Gangetic Alluvial Plains with soil pH 6.7.

Experimental details

The plants were manured with six organic manures like cowdung, neem cake, poultry manure, vermicompost, phosphocompost and mustard cake along with inorganic source of nitrogen *viz.* urea. Full dose of organic manure including recommended dose of P (Single Super Phosphate) and K (Muriate of Potash) and 50% dose of urea was applied as basal. Rest amount was applied after one month of transplanting.

The seedlings were planted in the plots measuring 4.5m x 1.5m with spacing of 60 cm (Row to Row) x 45 cm (Plant to Plant) following RBD with 19 treatments (Table 1)

and 3 replications. The plants in the control plot were grown only with P and K, but without any N. Matured green fruits were harvested from the plants in phases up to the drying of the plants. Observations were recorded on different growth, flowering behaviour and quality parameters and analyzed statistically (Gomez and Gomez, 1984). Capsaicin and Ascorbic acid content of chilli were estimated following Standard biochemical method (Sadasivam and Manickam, 1996).

Results and Discussion

Plant height (cm)

The average plant height of chilli (69.56 cm) was found maximum with 50% N from Vermicompost + 50% N from Urea. It was seen that plant height increased with the increase in the level of inorganic nitrogen (25 to 75%) and with reduced level of organic manure. Whereas, reverse effect was found with neem cake, poultry manure, vermicompost and phosphocompost. The minimum (61.24cm) plant height was recorded in treatment T₁₉ (control plot). Similar findings were also reported by Chandrappa *et al.*, (2007) in chilli. It shows that the effect of nitrogenous fertilizers has similar effect on plant height of chilli, but varies with the changes in dose of nitrogen.

Number of branches per plant

The average number of branches per plant was found maximum (16.01) under the treatment with 50% N from vermicompost + 50% N from Urea (T₁₁) over other treatments. Whereas, number of branches per plant (12.83) was found the least, when plant was grown with only P and K (Control), Yadav and Vijayakumari (2004) found maximum chlorophyll content in chilli plant with VC as compared to other organic manures used.

Table.1 Effect of source and combination of nitrogen on growth, growth attribute and fruit yield of chilli (pooled data of two years)

Treatments	Plant height (cm)	No. of branches/plant	Days required for first flowering	No. of fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit yield (t/ha)
T ₁ : 25% N(CM) +75% N(IN)	64.34	12.87	48.25	85.86	3.24	4.57	6.05
T ₂ : 50% N(CM) + 50%N(IN)	65.21	13.39	45.00	93.33	2.75	4.40	6.22
T ₃ : 75% N(CM) +25% N(IN)	62.72	13.01	44.36	90.75	3.46	4.32	6.15
T ₄ : 25% N(NC) + 75%N(IN)	63.16	13.17	47.37	110.75	3.45	5.06	7.27
T ₅ : 50% N(NC)+ 50%N(IN)	65.23	13.28	46.18	117.45	3.48	5.19	7.56
T ₆ : 75% N(NC) + 25%N(IN)	66.32	13.13	44.97	112.12	3.51	5.35	7.35
T ₇ : 25% N(PM) + 75%N(IN)	62.10	13.49	48.21	85.36	2.87	4.10	6.08
T ₈ : 50% N(PM) + 50%N(IN)	67.38	15.47	45.33	108.26	2.95	4.50	7.25
T ₉ : 75% N(PM) + 25%N(IN)	68.19	14.43	44.37	98.28	2.95	4.10	6.93
T ₁₀ : 25% N(VC)+75%N(IN)	66.47	15.08	46.28	129.75	3.76	5.57	8.27
T ₁₁ : 50% N(VC)+ 50%N(IN)	69.56	16.01	44.52	136.37	3.98	5.70	8.65
T ₁₂ : 75% N(VC +25% N(IN)	68.42	15.18	42.75	131.85	3.66	5.27	8.46
T ₁₃ : 25% N(PC) + 75%N(IN)	66.34	13.46	47.56	88.16	3.19	3.67	6.00
T ₁₄ : 50% N(PC) + 50%N(IN)	64.31	14.06	46.37	106.17	2.99	3.80	6.95
T ₁₅ : 75% N(PC) + 25%N(IN)	65.54	13.72	43.25	102.24	3.05	3.92	6.72
T ₁₆ : 25% N(MC)+75% N(IN)	66.72	14.25	46.18	105.27	3.27	3.82	6.88
T ₁₇ : 50% N(MC)+50% N(IN)	65.59	14.72	45.42	125.25	3.36	4.99	8.06
T ₁₈ : 75% N(MC)+25% N(IN)	63.32	14.36	45.05	109.75	3.26	4.93	7.15
T ₁₉ : Control	61.24	12.83	44.32	76.38	2.87	3.64	5.32
S.E.m	0.356	0.195	0.677	2.002	0.333	0.606	0.626
CD at 5%	1.060	0.580	2.010	5.945	0.980	1.800	1.060

Days required to first flowering

Application of N @ 75% through vermicompost and rest from urea induced advanced flowering in plants (T₁₂) as compared to all other treatments. On the other hand, flowering

Length of fruit (cm)

The data of the length of fruit presented in table 1 which shows that 50% N from vermicompost + 50% N from urea (T₁₁) produced longer fruit (3.98), which was statistically at par with T₁₀ (25% N from vermicompost + 75% N). Whereas, the minimum (2.87cm) fruit length was obtained from T₁₉ (control).

Fruit girth (cm)

The effect of organic manure with different level of inorganic fertilizer also influenced the fruit girth to a considerable extent. Among the different treatments the maximum (5.70 cm) fruit diameter was recorded in T₁₁ (50% N from vermicompost + 50% N from urea). The minimum was observed in (3.64 cm) Control plot (T₁₉).

Fruit yield (t/ ha)

The fruit yield per hector showed highly significant variation. It is evident from the data that the treatment T₁₁ (50% N from vermicompost + 50% N from urea) significantly produced the highest yield per hectare compared to other treatments.

Various organic manures when mixed with growing media showed their significant role to boost yield of chilli like other parameters. When soil was enriched with vermicompost and urea, 50% more yield was found, whereas, other organic manures like cow dung manure, poultry manure, neem cake,

phosphocompost and mustard cake improved yield to some extent, but not up to the mark of the above mention treatment. The maximum (8.65t/ha) fruit yield was obtained when plants were treated with 50% N from vermicompost + 50% N from urea (T₁₁). Chopra *et al.*, (2005) found the superior yield of chilli genotypes with organic and inorganic nutrient combination. Usha Rani *et al.*, (2002) observed that the availability of phosphorus contents increased up to 200% in the soil during cultivation of chilli, when NPK +FYM @ 10 tons/ha is used in the soil followed by vermicompost @ 2.5 tonnes/ha with the same level of inorganic fertilizer.

Capsaicin and Ascorbic Acid content of Fruits

Fruit samples were collected when the fruits started ripening and were analyzed to find out the capsaicin and ascorbic acid status of the fruits. The highest content of capsaicin and ascorbic acid in fruit were recorded when plants were treated with 25% N from Neem cake and 75%N from urea (T₆) followed by 50%N from Cow dung manure + 50%N taken from urea (T₅). These results are in agreement with the results of Grubben and El-Tahir (2004) who confirmed that vitamin C content of hot paper exceeds the value in tomato such that one serving of red pepper fruits contains nearly twice the daily requirement.

In conclusion, from the result it may be concluded that application of organic manure specially vermicompost may replace up to 50% of inorganic nitrogen fertilizers requirement of the crop to produce the maximum fruit yield. Qualitative characters, especially antioxidants like ascorbic acid and capsaicin content in fruit may be improved to a maximum extent with addition of neem cake in soil @75% of total N requirement of the crop.

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