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Effect of urea and vermicompost on growth, yield and fruit quality of chilli (*Capsicum annum* L.) under Prayagraj agroclimatic condition

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Abstract

A investigation was carried at the Horticultural research farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during Rabi Season, 2023 with a view to identify the effects of different doses urea and vermicompost and its role in growth, yield and quality of Chilli. The experiment was laid in the randomized block design with 8 treatments and 3 replication with different combination of urea and vermicompost. Eight treatment of vermicompost at three level (25%, 50% and 75%) in different combinations were applied along with Urea at four levels (25%, 50%, 75% and 100%). Result showed that plant height and number of branches per plant was found maximum with a 100% urea RDF. 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 100% Urea RDF level. From the above experimental finding it may concluded that, the application of T₁ (100% Traditional urea as RDF) was found to best in terms of growth, yield and quality. The highest net return (Rs. 66092) was found in the T₁ (100% Traditional urea as RDF) and highest B:C ratio was found in the same treatment with 2.51.

Keywords: Chilli, urea, nano urea and vermicompost

Introduction

Chilli (*Capsicum annum* L.) belongs to the family Solanaceae, is one of the most important commercial vegetable crops in India. Chilli cultivation is done both in *Rabi* (Winter) and *Kharif* (Summer) season in India. People prefer to consume both in dried and green stage, for its colour, pungency and spicy taste. Chilli also known as hot pepper was introduced into India from Brazil in 16th century by the Portuguese. It is cash crop in India and it has medicinal value too. It is enriched in vitamin A, C, B, E & minerals. It is a diploid cross-pollinated dicot plant species with chromosome number $2n=2x=24$ (Aryal, 2016)^[2].

Vermicompost is a organic manure which is a by-product of earthworm and it contains macro and micro nutrients. It has no side effect on soil health and have high porosity, aeration water holding capacity and good drainage in the soil. It improve plant growth and yield.

Urea is a inorganic from of nitrogen fertilizers. Urea enter into the plant directly and in other form like ammonium or nitrate after degradation of urea into the soil by soil microbes. Not more the recommended dose of urea can be given at the time of basal dose during crop production because the roots are tiny and not able to uptake the nutrients from the soil. And then urea is wasted in the form of volatilization and leaching. The best time to provide the urea into the soil is evening time.

Nano-urea play a crucial role in agriculture by enhancing crop growth, yield, and quality while improving nutrient use efficiency and reducing fertilizer wastage and cultivation costs. These fertilizers can be applied to the soil or leaves, making foliar application possible even in unfavourable soil and weather conditions. Nano urea is developed by nanotechnology by IIFCO. Nano scale particles present in the Nano urea is (10-9). Average physical size of Nano Urea particles is in the range of 10 -50 nm. It contains 4% nitrogen by weight in its Nano liquid form.

It has small size (20-50 nm).

2. Materials and Methods

2.1 Experimental materials

Table 1: Details of Treatment Combinations:

Symbol	Treatment
T ₁	100% Urea RDF
T ₂	100% Nano-Urea as Foliar spray RDF
T ₃	75% Recommended dose of Nano-urea as Foliar spray + 25% Vermicompost
T ₄	75% Recommended dose of Urea as Traditional fertilizer + 25% Vermicompost
T ₅	50% Recommended dose of Nano-urea as Foliar spray + 50% Vermicompost
T ₆	50% Recommended dose of Urea as Traditional fertilizer + 50% Vermicompost
T ₇	25% Recommended dose of Nano-urea as Foliar spray + 75% Vermicompost
T ₈	25% Recommended dose of Urea as Traditional fertilizer + 75% Vermicompost

3. Results and Discussion

3.1. Growth Parameters

3.1.1 Effect of urea and vermicompost on germination and survival percentage

Days to germination of chilli plant in field represents in the table 4.1. The maximum number of days taken to germination of plants with the treatment T₄ (75% Recommended dose of Urea as Traditional fertilizer + 25% Vermicompost) was 11.81 days and the minimum number of days to germination was found the treatment T₆ (10.57 days). The data presented in Table 4.1 revealed that application of urea and vermicompost covers significantly encouraged the early initiation of germination. So, it is a most important factor which determines early crop production. Similar Finding were reported by Kumar *et al.*, (2016).; Parani and Nanthini *et al.* 2021^[9].

Survival percentage of chilli plant represents in the table 4.1. The maximum survival of plants with the treatment T₂ (100% Nano-Urea as Foliar spray RDF) was 100 Percent and the minimum survival percentage of germination was found the treatment T₅ (88.89 percent).

3.1.2. Effect of urea and vermicompost on plant height and no of branches.

Maximum height was reported in 100% Urea RDF (T₁) with an average height of 75.68 cm. All the treatments significantly increase plant height as compared to control. Minimum plant height 52.68 cm was recorded (T₂). The possible growth promoting effect mechanism, usually attributed to hormone like impact, photosynthesis activation, accelerate the cell division, plant cell membrane permeability will be increase and nutrient uptake improved and biomass production activated finally by were reported by Ahmed *et al.*, Parani and Nanthini; Singh *et al.*, (2017)^[12].

The highest number of primary branches per plant at 90 DAS was observed in 25% Recommended dose of Nano-urea as Foliar spray + 75% Vermicompost (T₇) (6.80) which was statistically at par with all other treatments. All the urea and vermicompost had the positive effect on generating and retaining higher number of branches per plant. Least number of primary branches per plant was recorded in Treatment T₁ (5.40). It was concluded that more number of branches were recorded in urea and organic fertilizer treated plots as compared to control. It might be due to favorable microclimatic conditions and soil

moisture conservation with the use of urea and vermicompost which results in better vegetative growth leads to increase in number of branches per plant. The present study finds support were reported by Mishra *et al.*, Ahmed *et al.*, Yeptho *et al.*, (2012)^[15].

3.1.3. Effect of urea and vermicompost on Leaf area (cm²)

Leaf area is a characterise plant canopy. It was observed that all the treatments were effective in increasing leaf area of the chilli plants as compared to other. It was noticed that among the urea and organic fertilizer treatments, the leaf area index of 194.76 cm² was recorded with the 100% Urea RDF (T₁) application which was significantly higher as compared to rest of treatments. Minimum value of leaf area 136.35 cm² was reported 100% Nano-Urea as Foliar spray RDF (T₂) which was significantly lower from rest of treatments.

3.1.4. Effect of urea and vermicompost on days to 1st flowering

Days to 1st Flowering represents among the urea and organic fertilizer treatments, minimum number of days taken by plants to reach anthesis stage after transplanting were recorded when the plants urea and vermicompost with 100% Urea RDF (T₁). It took about 45.09 days after transplanting which was significantly earlier from rest of treatments days after transplanting. Among urea and vermicompost treatments minimum number of days taken to flower initiation was observed under 100% Nano-Urea as Foliar spray RDF (T₂) (37.04). Ahmed *et al.*, Parani and Nanthini *et al.* 2021^[9]

3.1.5. Effect of urea and vermicompost on Days to 50% flowering

The evaluation of the data showed significant effect of urea and organic fertilizer in early days to 50% flowering of chilli. Among the urea and vermicompost treatments, it was noticed that minimum number of days were taken for the Days to 50% flowering when the plants were 100% Nano-Urea as Foliar spray RDF (T₂) 44.59 days after transplanting. The further perusal of the data revealed application the maximum number of days were taken by plant to reach days to 50% flowering by the application 100% Urea RDF (T₁) took 51.29 days The difference among urea and vermicompost treatments were significant. The availability of nutrient through urea and vermicompost consistency means might have increase the extra nutrient requirement caused because of early flowering coupled with concomitant flower number increase and fruit development Tamilselvi and Vijayaragavan (2014)^[14].

3.1.6. Effect of urea and vermicompost on fruit length, fruit width and fruit girth

Maximum fruit length was observed in 75% Recommended dose of Nano-urea as Foliar spray +25% Vermicompost (T₃) (7.40 cm). Maximum fruit girth was observed in 100% Urea RDF (T₁) 1.95 cm and minimum girth observed with treatment T₈ (1.88 cm). Maximum fruit weight was observed in 25% Recommended dose of Nano-urea as Foliar spray + 75% Vermicompos (T₇) 2.41 cm and minimum fruit weight observed with 25% Recommended dose of Urea as Traditional fertilizer +75% Vermicompost T₈ with (2.23 cm). Maximum fruit diameter was observed in 25% Recommended dose of Urea as Traditional fertilizer +75% Vermicompost (T₈) (0.72 cm) which might be due to more adequate moisture conditions which helps in better redemption of nutrient for crop hence providing vigorous growth of crop and fruits. The present study finds

support of Ashrafuzzaman *et al.*, (2011) [4] who reported that fruit length, fruit width and number of seeds per fruit of chilli were statistically similar over the urea and organic fertilizer treatments. Parani and Nanthini *et al.* 2021 [9]

3.1.7. Effect of urea and vermicompost on yield parameter

In present study, fruit yield was directly associated with number of fruits per plant as number of fruits per plant increases fruit yield proportionately. The data on number of fruits per plant presented in Table 4.2 revealed that there was wide variation among the treatments regarding this factor. The maximum number of fruits (59.99) was recorded in 100% Urea RDF (T₁) which was significantly higher from rest of the treatments. The minimum number of fruits per plant i.e. 29.01 recorded in the 1 treatment T₇ which was lower significantly. Maximum fruit yield per plant i.e. 109.60 g was obtained in 100% Urea RDF (T₁) which was significantly higher from rest of the treatments. The minimum fruit yield per plant i.e. 50.95 g recorded from the plot which was kept control (T₇) and it was significantly lower from rest of treatments.

The data showed that maximum yield of 36.53 (q/ha) with the treatment 100% Urea RDF (T₁) was reported using urea and vermicompost where followed by treatment (T₄) with the value of 36.12 (q/ha). Minimum fruit yield of chili was recorded in weedy check (T₇) (16.98) Rather *et al.*

The popularity of urea and vermicompost in agriculture is associated with the opportunity of acquiring better yields without the want to stop the manufacturing of ecological plants. urea and vermicompost have a tremendous effect on yielding vegetation. The yield is generally determined as the amount of fruit obtained from one plant or plot. The yield relies upon on

the form of remedy used, the dose, the approach of software, and the plant range. Multiplied yield is frequently related to improving the high-quality of veggies or fruit. that is specially important in natural farming, in which artificial fertilizers cannot be used Singh and Singh, (2019) [13].

3.1.8. Effect of urea and vermicompost on Ascorbic acid and TSS

Ascorbic acid is a natural occurring compound with antioxidant properties. Among the various treatments (T₆) led to maximum increase in ascorbic acid content of 141.06 mg/100g on an average which is significantly higher from rest of treatments and followed by (T₅) (140.70) and (T₇) (139.68). The further perusal of the data showed that urea and vermicompost treatments had significant effect on increasing ascorbic acid content of chilli fruits as compared to control but difference among them was significant. Minimum amount of vitamin-C was reported in control treatment (T₁) (125.81) which was significantly. Similar finding of using these urea and vermicompost, fruit taste values improved significantly, as evidenced by the increase in the level to an average of Ascorbic acid content. Ahmed *et al.*, Roupheal *et al.*, (2018) [10]

TSS (⁰Brix) was significantly varied with all the treatment concerned. Among the treatment used urea and vermicompost and have highest TSS ⁰B which were significantly superior than T₁ and other treatment. The maximum TSS value in chilli was recorded in 100% Urea as RDF T₈ with 4.51 ⁰B and the minimum was recorded in T₁ with 3.02 ⁰B. Similar finding of using these urea and vermicompost, fruit taste values improved significantly, as evidenced by the increase in the level to an average of Ascorbic acid content. (Roupheal *et al.*, 2018) [10].

Table 2.1: Effect of urea and Vermicompost on growth parameters on chilli.

Treatment	Days to germination	Survival percentage	Plant height at first harvest	No of branches (90 Days)	Leaf area (cm ²)	Days to first flowering	Days to 50% flowering
T ₁	11.15	94.44	75.68	5.40	194.73	45.09	51.29
T ₂	11.4	100	52.67	5.53	136.35	37.04	44.59
T ₃	11.25	94.44	65.71	5.80	191.14	43.6	49.97
T ₄	11.81	100	56.74	5.93	141.26	40.18	46.11
T ₅	10.99	88.89	64.43	6.33	188.74	42.89	46.61
T ₆	10.57	94.44	63.69	6.67	177.21	42.14	48.72
T ₇	11.49	100	62.78	6.80	159.46	40.52	48.41
T ₈	11.18	94.44	55.06	6.27	137.07	38.6	45.42
F test	S	S	S	S	S	S	S
SEM	0.13	1.39	2.58	0.18	8.94	0.95	0.83
CD at 5%	0.05	0.56	1.03	0.07	3.57	0.38	0.33
C.V.	3.25	4.1	11.76	8.37	15.25	6.49	4.9

Table 3: Effect of urea and Vermicompost on growth and yield parameters on chilli

Treatment	Fruit length (cm)	Fruit weight (g)	Fruit girth (cm)	Fruit Diameter (cm)	Number of fruits/ plant	Yield/plant (g)	Yield (q/ha)
T ₁	7.35	2.38	1.95	0.64	59.99	109.60	36.53
T ₂	7.16	2.38	1.89	0.64	53.79	105.24	35.07
T ₃	7.4	2.35	1.93	0.64	53.34	106.61	35.53
T ₄	7.2	2.25	1.94	0.63	56.96	108.37	36.12
T ₅	7.24	2.33	1.93	0.65	35.83	75.20	25.06
T ₆	7.18	2.25	1.94	0.65	41.34	85.21	28.40
T ₇	7.12	2.41	1.91	0.66	29.01	50.95	16.98
T ₈	7.12	2.23	1.88	0.72	38.23	73.99	26.66
F test	S	S	S	S	S	S	S
SEM	0.04	0.02	0.01	0.01	4.01	6.44	1.08
CD at 5%	0.01	0.01	0	0	1.61	2.57	0.43
C.V.	1.46	3	1.29	4.46	24.64	19.81	23.84

Table 4: Average sensory scores of treated sample of chilli beverages

Treatment	TSS(^o Brix)	ASCORBIC ACID (mg/100g)
T ₁	3.02	125.81
T ₂	4.07	136.06
T ₃	4.18	137.63
T ₄	4.21	139.06
T ₅	4.3	140.7
T ₆	4.34	141.03
T ₇	4.38	139.68
T ₈	4.51	137.7
F test	S	S
SEM	0.16	1.73
CD at 5%	0.07	0.69
C.V.	11.3	3.57

Table 5: Economics of Chilli

Treatments	Cost of cultivation (Rs/ha)	Total yield (q/ha)	Selling Rate (Rs/kg)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit- cost ratio
T ₁	43498	36.53	30	109590	66092	2.51
T ₂	44391	35.07	30	105210	60819	2.37
T ₃	45278	35.53	30	106593	61323	2.35
T ₄	46168	36.12	30	108361	62193	2.34
T ₅	45391	25.06	30	75180	29789	1.65
T ₆	45278	28.40	30	85555	40277	1.88
T ₇	47168	16.98	30	50940	3772	1.07
T ₈	46872	24.66	30	73980	27108	1.57

The maximum Cost of cultivation (Rs.), gross return, net return and benefit cost ratio was recorded in the Treatment T₁ with cost of cultivation Rs. 43498, Gross return Rs. 109590 and Net Return Rs 66092 and Benefit cost ratio Rs 2.51.

Conclusion

It is concluded that the application of T₁ (100% Traditional urea as RDF) recorded better growth, quality & higher yield. and highest B:C ratio i.e. 2.51

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