



Effect of macro and micronutrients fertilization on yield parameters and yield of hybrid chilli in sandy clay loam soils of Cuddalore district, Tamil Nadu

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Abstract

Vegetables play a vital role in health and nutrition of people throughout the world. Chilli is one of the commercially important vegetable crop extensively grown throughout India for its nutritive value and medicinal properties. A field experiment was conducted at farmers field in Vanniyarpalayam village, Kurinjipaditaluk, Cuddalore district, Tamil Nadu with chilli hybrid mahyco sierra as test crop, during Feb 2020 – May 2020 to evaluate the response of hybrid chilli to macro and micronutrients fertilization in sandy clay loam soils of Cuddalore Dt., Tamil Nadu. The experimental soil was sandy clay loam with a pH of 5.7, EC of 0.26 dsm^{-1} . The available N, P, K and B content of soil were 196 (Low), 9.5 (Low), 232 (Medium) kg ha^{-1} and 0.074 mg kg^{-1} (Low). The treatments consisted of application of inorganic fertilizers like Complex fertilizer (17:17:17) @ 0.5% foliar spray, DAP @ 0.5% foliar spray and Borax @ 0.5% foliar spray were applied in different combinations. The experiment was laid out in randomized block design and replicated three times. The growth and yield parameters were recorded at 30, 60, 90 and 120 DAT. The experimental findings revealed that among the different treatments tried, the highest value of yield parameters regarding number of flowers plant^{-1} (110.20) and days to 50% flowering number of fruits plant^{-1} (27 days), number of fruits plant^{-1} (91.26) fruit length (14.18 cm), fruit girth (5.44 cm), single fruit weight (6.51 g), number of seeds fruit^{-1} (123.14), thousand seed weight (6.42 g), fruit yield (170 q ha^{-1}) were recorded from the application of (RDF + Complex fertilizer 17:17:17 @ 0.5% foliar spray + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray). By considering all the benefits, T₈ (RDF, Complex fertilizer 17:17:17 @ 0.5% foliar spray, DAP @ 0.5% foliar spray and Borax @ 0.5% foliar spray) would greatly benefit the farmers to realize higher chilli fruit yield and profit in sandy clay loam soils of Cuddalore district.

Keywords: micronutrients fertilization, hybrid chilli, sandy clay loam soils

Introduction

Chilli is a remunerative vegetable, spice cum cash crop of the Indian subcontinent. Chilli is used as both vegetable and spice crop. Chilli peppers originated in Mexico (Kraft *et al.*, 2013) [5]. In 21st century Asian cuisine, chilli peppers are commonly used across diverse regions. The genus of capsicum contains 20 species and now five domesticated species are *Capsicum annum*, *Capsicum frutescens*, *Capsicum chinense*, *Capsicum baccatum*, *Capsicum pubescens* are only recognized (Islam *et al.*, 2018) [3]. Chilli is famous for its nutritional value, medicinal effects and therapeutic treatments, in addition it is used as an organic colouring and flavouring agent in food industries. Chillies are the good source of Vitamin - A, B, C and E (Tocopherol), Oleoresin, Carbohydrates and minerals such as Calcium, Phosphorous, Ferrous, Sodium and Copper in trace amounts (Prathibha *et al.*, 2013) [10]. The pungency principle is due to the presence of *Capsaicin* ($\text{C}_{18}\text{H}_{27}\text{NO}_3$) synthesized in the epidermal cells of placenta of the fruits and possess inflammatory and anti-oxidant activities (Anupam, 2016). India is the world leading country in Chilli production followed by China and Pakistan. During 2021, Indian red chilli production is expected to be around 12,32,000 metric tonnes. Chilli generally takes up large amount of nutrients that have specialized functions and should be supplied to plant at the right time with suitable quantity. When chillies are adequately supplied with the

essential nutrients through fertilization it improves their yield, quality and enhance maturity. Generally, nitrogen enhances the metabolic processes that based on protein, leads to increases in vegetative, reproductive growth and yield of the crops (Leghari *et al.*, 2016) [7]. Phosphorous is important in seed germination, seedling establishment, root, shoot, flowers and seed development (Muindi, 2019) [8]. Potassium nutrition has also been associated with increased yields, fruit size, increased soluble solids and ascorbic acid concentrations, improved fruit colour, increased shelf life and shipping quality of many horticultural crops. In chillies Boron, which are brought out to be useful in increasing fruit set and reducing fruit drop. Micronutrients are completely available to the plant and thus particularly effective because they are not fixed or diluted in large volumes of soil. Foliar fertilizers are being used in vegetables and fruit crops that contain various macro and micronutrients. Besides, foliar application of various macro and micronutrients has been proved beneficial, foliar feeding is a relatively new technique of feeding plants by applying liquid fertilizer directly to their leaves also they are known to immediately deliver nutrients to the tissues and organs of the crop (Baloch *et al.*, 2008) [2]. Considering the significance of foliar fertilizers for chillies, the present study was therefore under taken to investigate the impact of nitrogen, phosphorous, potassium and boron fertilizers on yield parameters and yield of hybrid chilli.

Materials and Methods

Field experiment was conducted at farmers field, Vanniyarpalayam village, Kurinjipadi taluk, Cuddalore district during February 2020 – May 2020 to study the response of hybrid chilli to macro and micronutrients fertilization in sandy clay loam soils of Cuddalore Dt., Tamil Nadu with hybrid chilli mahyco sierra as test crop under irrigated condition with eight treatments replicated thrice in a randomized block design. The experimental soil was sandy clay loam. The treatments were T₁ - (100 % RDF alone), T₂ - (RDF + Borax @ 10 kg ha⁻¹), T₃ - (RDF + Borax @ 0.5% Foliar spray), T₄ - (RDF + Complex fertilizer 17:17:17 @ 0.5% Foliar spray), T₅ - (RDF + DAP @ 0.5% Foliar spray), T₆ - (RDF + Complex fertilizer 17:17:17 @

0.5% Foliar spray + Borax @ 0.5% Foliar spray), T₇ - (RDF + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray) and T₈ - (RDF + Complex fertilizer 17:17:17 @ 0.5% foliar spray + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray). Recommended dose of fertilizers were applied uniformly in all plots. Application of inorganic fertilizers like Complex fertilizer (17:17:17), DAP and Borax were given as 0.5% foliar spray as per the treatment schedule. Yield and yield parameters were recorded at different growth stages at 30, 60, 90 and 120 DAT of hybrid chilli production.

Results and Discussion

Yield parameters (Table 1)

Table 1: Effect of macro and micronutrients on number of flowers plant⁻¹ and days to 50 per cent flowering of hybrid chilli

Treatment particulars	Number of flowers plant ⁻¹	Days to 50 per cent flowering
T ₁ - RDF	83.60	29.00
T ₂ - RDF + Borax @ 10 kg ha ⁻¹	90.69	28.00
T ₃ - RDF + Borax @ 0.5% Foliar spray	88.35	29.00
T ₄ - RDF + Complex fertilizer @ 0.5% Foliar spray	97.94	27.00
T ₅ - RDF + DAP @ 0.5% Foliar spray	95.44	28.00
T ₆ - RDF+ Complex fertilizer @ 0.5% Foliar spray + Borax @ 0.5% Foliar spray	105.44	27.00
T ₇ - RDF + DAP @ 0.5% foliar spray + Borax @ 0.5 % foliar spray	102.69	27.00
T ₈ - RDF + Complex fertilizer @ 0.5 % foliar spray + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray	110.20	27.00
S.Ed.	2.24	0.68
CD (p=0.05)	4.72	1.44

Table 2: Effect of macro and micronutrients on yield parameters of hybrid chilli

Treatment particulars	Number of fruits plant ⁻¹	Fruit length (cm)	Fruit girth (cm)	Single fruit weight (g)	Number of seeds fruit ⁻¹	1000 seed weight (g)	Fruit yield (q ha ⁻¹)
T ₁ - RDF	65.89	9.95	4.25	4.70	95.68	4.52	129.54
T ₂ - RDF + Borax @ 10 kg ha ⁻¹	72.42	11.12	4.54	5.18	102.41	4.98	139.87
T ₃ - RDF + Borax @ 0.5% Foliar spray	70.57	10.84	4.49	5.14	101.76	4.91	137.73
T ₄ - RDF + Complex fertilizer @ 0.5% Foliar spray	79.32	12.19	4.83	5.63	109.34	5.46	150.63
T ₅ - RDF + DAP @ 0.5% Foliar spray	77.43	11.98	4.80	5.60	108.62	5.33	148.16
T ₆ - RDF+ Complex fertilizer @ 0.5% Foliar spray + Borax @ 0.5% Foliar spray	86.18	13.29	5.14	6.08	116.57	5.96	161.52
T ₇ - RDF + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray	84.32	13.00	5.11	6.04	115.73	5.91	158.87
T ₈ - RDF + Complex fertilizer @ 0.5% foliar spray + DAP @ 0.5% foliar spray + Borax @ 0.5% foliar spray	91.26	14.18	5.44	6.51	123.14	6.42	170.04
S.Ed.	1.76	0.20	0.09	0.12	2.38	0.13	3.42
CD (p=0.05)	3.68	0.43	0.19	0.26	4.97	0.26	7.21

Number of flowers plant⁻¹

Number of flowers plant⁻¹ varied significantly among different treatment combinations and ranged from 83.60 to 110.20. Among the various treatment combinations tested, the treatment T₈ was found to be the highest, as it recorded maximum number of flowers plant⁻¹ i.e., 110.20, followed by the treatment T₆ which counted the value of 105.44. The least number of flowers plant⁻¹ (83.60) was registered in the RDF treatment. The treatment T₆ and T₇ were on par with each other. The reason for increased 114 fruit characters might be due to readily available N due to the application of N, P and K may also be the prime factor for the increased fruit length and fruit girth in chilli (Babitha, 2015) [1]. The increased fruit length, number of fruits per plant and size of fruit in chilli were attributed to balanced macro and micronutrient ratio, more mineralization, more availability of native and applied macro and micro nutrients, more solubilization effect and availability of nutrients by addition of chemical fertilizers and more physiological activity

leading to buildup of sufficient food reserves for the developing sinks and better portioning towards the developing fruit. Lal and Kanaujia (2013) [6] expressed the same views.

Days to 50 per cent flowering

From the data it is observed that the number of days to fifty per cent flowering was significantly decreased due to various treatment combinations. The treatment T₈ which recorded lowest number of days (27.00) to reach fifty per cent flowering in chilli and it was followed by T₆. The treatment T₆ and T₇ are on par with each other. This was closely followed by T₄, T₅ and T₇.

Whereas RDF taken maximum number of days to fifty per cent flowering viz., 29.00 days. Early flowering encourages in increasing the number of fruits and total yield of the crop plants. In the present investigation, it was revealed that application of various complex fertilizers, borax and RDF

have got significant effect earliness of crop in terms of reducing the number of days to 50 per cent flowering. It could be indicated that the added nutrients influenced the days to 50 per cent flowering in chilli. Another reason for earliness in flowering in the best treatment could be due to better nourishment of plant through the combination of complex fertilizers with borax. The results were in accordance with the findings Jilani *et al.* (2008) and Babitha (2015). This was confirmed by significant positive correlation between fruit yield and DMP ($r=0.997^{**}$) and plant height ($r=0.999^{**}$) in sandy clay loam soil.

Number of fruits plant⁻¹

Data pertaining to different treatment combinations higher number of fruits plant⁻¹ (91.26) was recorded with the application of RDF, complex fertilizer 17:17:17 @ 0.5% foliar spray, DAP @ 0.5% foliar spray and borax @ 0.5% foliar spray. Treatment T₆ and T₇ values were on. The least number of fruits plant⁻¹ (65.89) was noticed in RDF treatment. The reason for increased 114 fruit characters might be due to readily available N due to the application of N, P and K may also be the prime factor for the increased fruit length and fruit girth in chilli (Babitha, 2015) [1].

Fruit length and fruit girth (cm)

From the data it appeared that maximum fruit length (14.18 cm) and fruit girth (5.44) were measured in T₈ (RDF, Complex fertilizer (17:17:17 and DAP) @ 0.5% foliar spray and borax @ 0.5% foliar spray). The RDF treatment (T₁) registered least value of fruit length and fruit girth of 9.95 cm and 4.25 cm respectively. The increased fruit length, number of fruits per plant and size of fruit in chilli were attributed to balanced macro and micronutrient ratio, more mineralization, more availability of native and applied macro and micro nutrients, more solubilization effect and availability of nutrients by addition of chemical fertilizers and more physiological activity leading to buildup of sufficient food reserves for the developing sinks and better portioning towards the developing fruit. Lal and Kanaujia (2013) [6] expressed the same views.

Single fruit weight (g)

Single fruit weight varied significantly among the treatments. Regarding single fruit weight, the data observed that, maximum single fruit weight was found from T₈ (6.51 g) which was followed by T₆ (6.08g). While minimum single fruit weight was recorded from T₁ (4.70 g). The treatment T₆ and T₇ lied on par with each other, but showed significant difference over control.

Number of seeds fruit⁻¹

Among the various treatment combinations tested, the treatment T₈ (RDF + complex fertilizer 17:17:17 @ 0.5% foliar spray + DAP @ 0.5 % foliar spray + borax @ 0.5% foliar spray) was found to be the best, as it recorded the highest number of seeds fruit⁻¹ (123.14), followed by the treatment T₆ (RDF+ complex fertilizer 17:17:17 @ 0.5% foliar spray + borax @ 0.5% foliar spray), which recorded the value of 108.62. The lowest number of seeds fruit⁻¹ (95.68) was registered in the RDF treatment. The treatment T₆ and T₇ were on par with each other

1000 seed weight (g)

From the data it is observed that T₈ counted highest 1000 seed weight of 6.42 g, followed by treatment T₆ (RDF + complex fertilizer 17:17:17 @ 0.5% foliar spray + borax @ 0.5% foliar spray), which recorded the value of 5.96 g. The RDF registered the least 1000 seed weight of 4.52 g. The treatment T₆ and T₇ values were on par. Increase in 1000 seed weight is an important yield component that determines the total fruit yield of chilli. Further, optimum availability of nutrient resources without any competition between the plants might have induced more amount of photosynthesis and translocation of synthates from sources to sink resulting in filling of endosperm and increased 1000 seed weight. The sufficient amount of nutrients would have enhanced photosynthesis and translocation resulting in increased 1000 seed weight, as reported by Kumari and Sharma (2006). The highest 1000 seed weight may be due to mobilization of reserve food materials to the sink for seed development process as reported by Sawhey *et al.* (1979) [11]. A significant positive correlation of DMP with fruit yield ($r=0.997^{**}$) lend to further support the present findings.

Fruit yield (q ha⁻¹) (Table 2)

Application of different types of inorganic fertilizers had great effect on the yield of hybrid chilli. The result revealed that the highest fruit yield (170.04 q ha⁻¹) was registered from T₈ treatment (combined application of complex fertilizers *viz.*, 17:17:17 and DAP as foliar spray, borax @ 0.5% foliar spray along with recommended dose of fertilizer) and it was followed by T₆ (RDF, complex fertilizer 17:17:17 @ 0.5% foliar spray along with borax @ 0.5% foliar spray treatment of 161.52 q ha⁻¹). Fruit yield values of T₆ and T₇ values were on par. Among the treatments, lowest fruit yield (129.54 q ha⁻¹) was registered in recommended dose of fertilizer treatment (T₁). Higher chilli yield recorded in this treatment might be due to availability of optimum quantity of required macro and micro nutrients through different nutrient sources and the release of which coincided with crop demand, besides improving the soil condition due to microbial population in soil, which enhanced root proliferation and synchronized source to sink relationship. The increase in fruit yield in the best treatment could be due to overall additive effect of NPK and boron applied through foliar nutrition as a supplemental dose on various growths, physiological, yield parameters and uptake of nutrients, finally resulted in higher fruit yield. These findings gain support from the results of Palaniappan *et al.* (1999).

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