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EFFECTS OF CHICKEN MANURE AND LIME ON GROWTH AND YIELD OF CHILLI (Capsicum frutescens L.)

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ABSTRACT

Chilli has been one of the commercial high value crops in An Giang. It was called as the universal spice of Vietnam, since it has been cultivated in almost all the districts. Hence, the present study was carried out to find out the effect of chicken manure, lime and NPK along with various treatments on growth and yield improvement of chilli. The experimental design was five treatments in randomized complete block with four replications. This study found that growth and yield of chilli were significantly influenced by different treatment combinations. Among the treatments, application of 0.5 tons CaO.ha-1 + 2 tons chicken manune. ha-1 + NPK, which had the maximum growth characters, were the plant height, number of tillers and leaves per plant. On the other hand, yield of chilli fresh that was 1,480 kg per 1,000 m2, was the highest value compared to other treatments. From the study it may be concluded that application of combined fertilizers recommended dose of organic and inorganic fertilizers along with liming 0.5 tons. ha-1 could help to increase the growth and yield of chilli.

1. INTRODUCTION

The chilli (*Capsicum frutescens* L.) is presently cultivated widely on a commercial scale in An Giang, chilli has been cultivated in an area of 1,500 hectares with an annual production of 7.46 tonnes (Nguyen Van Chuong, 2019). Chilli has commercially been important for the two qualities, the red colour due to the pigment capsanthin and the biting taste due to the chemical constituent capsaicin. However, farmers have been limited among the factors by lack of technology and the limited cultivation in the local country currently (Vimala *et al.*, 2007). Application of four rates (0, 20, 40, 60 tons poultry manure per ha) and three rates of inorganic fertilizer (0. 2 and 3 tons NPK.ha^{-1}) were evaluated on bird chilli grown on an upland clay soil (Vimala *et al.*, 2007). Capsaicin is a digestive stimulant, which prevents heart diseases and is curative for many rheumatic troubles. Besides, chilli is very useful in our daily diet since it is a rich source of vitamins A

Vietnam implemented administrative restructuring on July 1, 2025, introducing significant changes to its administrative units. Nevertheless, this article continues to use the old names of provinces, cities, communes, and wards to reflect the data and context at the time of the study.

and C, polyphenols, chlorophylls, carotenoids, sugars, magnesium, calcium, potassium, phosphorus and iron (Altintas & Acikgoz, 2012; Jadczak *et al.,* 2010). Application of organic fertilizers can improve soil physical and biological environment but suffers from drawback of low content of plant nutrient. On the other hand, application of chemical fertilizers alone can supply only one or two nutrient elements to the crop (Adhikari *et al.,* 2016). Among the various factors affecting the growth and productivity of chilli, the fertility of the soil is the prime consideration for increasing crop production. Improvement in growth and yield can be brought about by the application of different doses of essential nutrients (Challinor *et al.,* 2014). The beneficial effect of organic manure associated with elevated temperatures was found to have high efficiency in improving chilli peppers' nutrient content and crop productivity (Challinor, *et al.,* 2014). Application of lime, cow manure combined NPK had significantly improved the soil pH, OM, total available N, P K in chilli soil and higher than that of the control. The co-application of lime, cow manure and NPK increased the yield of chilli and the soil available characters were improved for all treatments (Nguyen Van Chuong, 2019). The prior study shows that the soil pH before and after the experiment ranged from 6.53 to 7.69. Due to the application of 3.5 tons of lime per ha in NT2 (lime+cow manure) and NT5 (lime + cow manure + NPK) during the fertilizing stage, the pH values in these treatments were higher pH values of the soil than before the experiment. The application of lime combined with cow manure and NPK increased yield of chilli (Nguyen Van Chuong, 2019). Therefore, the objectives of the study found out effects of chicken manure and lime on the growth and yield of chilli**.**

2. MATERIALS AND METHODS

The field experiments were carried out in the alluvium soil of Chau Thanh district, An Giang province, Vietnam during the Summer-Autumn crop of 2019 under drip irrigation system. The experiment was carried out in the field at areas inside the dyke with 5 treatments (Nguyen Van Chuong, 2019; Botir Khaitov, et al., 2019): NT1: applied belong to famers (NPK:90-60-60 kg.ha^{-1}), NT2 (0.5 ton CaO.ha^{-1} + 2 tons chicken manure.ha^{-1}), NT3 (2 tons chicken manure.ha^{-1}) NT4 (NPK+ 2 tons chicken manure.ha^{-1}) and NT5 (0.5 ton CaO.ha^{-1} + 2 tons chicken manure.ha^{-1} + NPK) with 4 replications. The kind of irrigation water (river water). Each treatment was an area of 80 m^2 (1 m x 20 m x 4 replications). The whole area of The field experiments was an area of 400 m^2 (80 m^2 x 5 treatments). The Chilli planted in a single row with distance of 50 cm x 30 cm (three seeds per hole), the distance between plants is 30 cm and row is 50 cm.

Each of the plot was fertilized with a basal dose of N, P and K at 90:60:60 kg. ha^{-1}, respectively (Hasan *et al.,* 2019). The inorganic fertilizers used were urea, muriate of potash and single super phosphate. The lime, PK and chicken manure were applied before planting except urea which was applied in two split doses. Fifty percent of nitrogen was applied as a basal dose before planting and the rest was top dressed 60 days after planting (Adhikari, et al., 2016; Nguyen Van Chuong, 2019; Vimala, *et al.,* 2007). Observations on growth characters (recorded at 20, 45, 65 days and harvest) like plant height, number of tillers and leaves per plant were recorded at 20, 45, 65 days and harvest and statistically analysed. Besides, observations on per plant, per pot and per hectare

yield of fresh fruits were recorded and statistically analysed.

3. RESULTS AND DISCUSSION

The pH results in soil (Table 1) showed quite suitable for growing chilli (pH = 6,66) (Bamidele & Eguagie, 2015). The total nitrogen was average level (0,188%) (Kramany *et al.*, 2007). The available photpho was not quite low level (30,1 mg/100g) (Kramany *et al.*, 2007). Especially, its low available K and poor organic matter content (0,153 meq/100g) (Habi, 2012) and (2,08%), respectively.

Table 1. Soil particle size distribution and chemical characteristics at the first of the experiment

No.	Characters	Results
1	pH_{H20}	6.66
2	Total N (%)	0.118
3	Available P (mg/100g)	30.1
4	Available K(meq/100g)	0.53
5	OM (%)	2.08

The results from Table 2 showed that treatment kind had significant effect on the soil pH, NPK, OM and C/N. On the other hand, the maximum soil total nitrogen percent was obtained by the NT5 treatment, while the highest soil available phosphorous, Available K and organic matter content were obtained by the NT2 treatment. The lowest C/N ratio (5.84) was obtained from the NT5 treatment, while the NT3 treatment had the maximum C/N ratio (6.99) compared to the other treatments. The organic matter of soil after the experiment was lower than the organic matter before the experiment (Table1 & 2). This can be explained by the fact that microorganisms in the soil use carbon to decompose OM. Plants respired to take the soil nutrition, which emitted a large amount of carbon dioxide (this is the reason for the reduction of OM after the experiment). Many researchers have confirmed that soil organic matter is a nutrient source closely related to soil fertility, especially in hot and humid tropical conditions. The organic matter of the whole treatments had significantly reduced after the experiment (Prasad *et al.*,2009, Nguyen Van Chuong, 2019).

Table 2. Results of Soil chemical analysis at the end of the experiment*

Treatments	ppH	Total N (%)	Available P (mg/100g)	Available K (meq/100g)	Total OM (%)	C/N
NT1(Control)	$6.87^{c●●}$	0.116^{c}	60.7^{c}	0.14^{b}	1.31^{d}	6.64^{b}
NT2	7.69^{a}	0.142^{b}	97.3^{a}	0.17^{a}	1.63^{a}	6.58^{b}
NT3	7.00^{b}	0.113^{c}	32.5^{d}	0.12^{d}	1.38^{c}	6.99^{a}
NT4	6.53^{d}	0.146^{b}	92.7^{b}	0.13^{c}	1.67^{a}	6.58^{b}
NT5	6.95^{bc}	0.153^{a}	92.1^{b}	0.14^{b}	1.53^{b}	5.84^{c}

Treatments	ppH	Total N (%)	Available P (mg/100g)	Available K (meq/100g)	Total OM (%)	C/N
F	*	*	*	*	*	*
CV(%)	13.4	11.8	12.8	3.09	12.1	11.2

**Values are the mean of four replicates.*

***: Means within each column having different letters, are significantly different according to LSD at 5 % level.*

Table 3. Effect of chicken manune and lime on Plant height of chilli*

Treatments	Plant height (cm)			
	20 days	45 days	65 days	harvest
NT1 (Control)	15.1^{c}	35.0^{ab}	46.0^{b}	58.2^{b}
NT2	14.7^{c}	31.1^{c}	32.7^{c}	41.7^{c}
NT3	11.8^{d}	22.6^{d}	29.6^{c}	37.0^{d}
NT4	17.7^{b}	34.5^{b}	47.5^{b}	59.8^{b}
NT5	19.4^{a}	37.5^{a}	63.0^{a}	70.6^{a}
F	*	*	*	*
CV (%)	6.57	5.65	9.44	4.58

** Values are the mean of four replicates. Means within each column having different letters, are significantly different according to LSD at* 5 *% (*)level.*

The result Table 3 showed that lime, chicken manune and NPK affected the height of chilli. The height increased by combining the rates of lime and chicken manune. In the treatment NT5, the maximum height of chilli was 19.4 cm, 37.5 cm, 63.0 cm and 70.6 cm in 20 days, 45 days, 65 days and harvest, respectively. On the contrary, lime combined cow manune in NT3 (Without NPK), chilli was the least of height about 11.8 cm, 22.6 cm, 29.6 cm and 37.0 cm in 20 days, 45 days, 65 days and harvest, respectively.

Number of leaves and tillers of chilli significantly influenced with all types of chicken manune, lime and NPK as presented in Table 3 & 4. The plant grown in NT5 had the maximum plant height, number of tillers/ plants, number of leaves/plants compared to othe treatments (Table 3, 4 & 5). The plants in NT3 (chicken manune) had the minimum plant height and the number of tillers, leaves of chilli were the lowest during the growth time compared to others (Table 3, 4 & 5). Similar results were obtained in previous studies (Bamidele & Eguagie, 2015; Hossain & Ishimine, 2007). Although the chilli growth and yield of NT5 treatment (NPK combined chicken manune and lime) were clearly identical to that of other organic manure treatments and it was statistically different from another treatment NT2 combining chicken manune and lime except plant height and number of tillers and leaves/plant. However, leaf number and plant height oly increased slightly with the only chicken manure application than those with others (Table 3, 4 and 5). The better performance of plants was probably because it acted as natural fertilizer with pesticidal properties which protects plant roots from nematodes, soil grubs and white ants and

performs as a nitrification inhibitor and prolongs the availability of nitrogen to short duration as well as long duration crops (Adhikari *et al.*, 2016; Hasan *et al.*, 2019). Beside these, it improves the soil condition considerably and protects the soil during the droughts. The chicken manune provided nutrients to the plants and may improve edaphic factors, which resulted in higher chilli growth parameters if combined with NPK and lime (Table 3, 4 and 5). These results are in good agreement with the findings of several researchers which revealed that the root, shoot, and fruit dry weights of chilli pepper of the co-application treaments of organic manure and inorganic increased by 21.4%, 52.4%, and 79.7%, respectively, compared to the control treatment in the greenhouse. the best solution for chilli pepper production under variable climate conditions might be the rational use co-application of organic, lime and inorganic (Botir Khaitov *et al.*, 2019; Vimala *et al.*, 2007; Nguyen Van Chuong, 2019;)

Table 4. Number of Chilli leaves as influenced by NPK, chicken manune and lime*

Treatments	No. of leaves of Chilli			
	20 days	**45 days**	**65 days**	**harvest**
NT1(Control)	15.4^{b}	49.1^{c}	169^{b}	207^{b}
NT2	15.0^{b}	33.0^{d}	123^{c}	163^{c}
NT3	13.2^{c}	22.8^{e}	101^{c}	104^{d}
NT4	19.8^{a}	53.9^{b}	180^{b}	263^{a}
NT5	21.1^{a}	58.4^{a}	254^{a}	286^{a}
F	*	*	*	*
CV (%)	6.42	4.88	11.5	8.28

** Values are the mean of four replicates. Means within each column having different letters, are significantly different according to LSD at 5 % (*) level.*

The treatment consisting of NPK along with chicken manune 2 tons per ha and lime 0.5 ton/ ha (NT5) exhibited the highest fresh harvest yield of chilli (1.480 kg per 1.000 m^2). Balanced nutrition of organic and inorganic nutrients maintains optimum ratio between the nutrients, which is of considerable importance in improving the yield. The analysis of variance for yield is presented in Table 6. Significant effects were obtained for all the chicken manune, lime and inorganic fertilizer (NPK) applications. Interaction effects were significant. Mean yields obtained are presented in Table 6. Yield/1.000 m^2 increased significantly from 302 kg at NT3 to a maximum of 1.480 kg/ 1.000 m^2 at NT5. All growth parameters were improved when peanut plants received advantage effects of lime and chicken manune. Moreover, a great potential of chilli growth resulted by co-lime with chicken manune. Continued application of other levels of lime and organic enhanced yield and reduced the need to chemical fertilizer, pesticide ultimate, conserved environment and braving sustainability (Nguyen Van Chuong, 2019; Sureyya & Funda, (2012).

Table 5. Number of Chilli Tillers as influenced by NPK, chicken manune and lime*

Treatments	No. of tillers per plant			
	20 days	45 days	65 days	harvest
NT1	1.30^{c}	14.0^{c}	26.1^{b}	31.8^{c}
NT2	1.20^{cd}	12.0^{d}	16.0^{c}	20.2^{d}
NT3	1.00^{d}	7.7^{e}	12.2^{c}	15.0^{e}
NT4	1.60^{b}	18.0^{b}	30.0^{b}	40.3^{b}
NT5	2.00^{a}	25.5^{a}	36.2^{a}	46.0^{a}
F	*	*	*	*
CV (%)	9.25	7.77	13.5	6.93

** Values are the mean of four replicates. Means within each column having different letters, are significantly different according to LSD at 5 % (*) level.*

Table 6. Effect of NPK, chicken manune and lime on yield of chilli*

Treatments	Yield (kg per 1.000 m^2)
NT1	1,078^{c}
NT2	430^{d}
NT3	302^{e}
NT4	1,275^{b}
NT5	1,480^{a}
F	*
CV (%)	6.0

** Values are the mean of four replicates. Means within each column having different letters, are significantly different according to LSD at 5 % (*) level.*

4. CONCLUSION

The co-application of organic, inorganic and lime had significant effect on the soil pH, NPK, OM and C/N ratio. The treatment differences for the various growth, yield of chilli were significant. Among the different treatments tried, application of 2 tons chicken manune, 0.5 tons CaO combined NPK at 90-60-60 per ha was superior and hence, it may be concluded that co-application of organic, inorganic and lime could help to increase the growth and yield of chilli.

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