The Asian Journal of Soil Science (2007) 2 (1) : 108-110

Effect of lignite humic acid and inorganic fertilizers on growth and yield of onion

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Accepted : *April, 2007*

ABSTRACT

To study the influence of lignite humic acid on the growth and yield of onion, a field experiment was conducted during *kharif* 2003 in a sandy clay loam soil belonging to somaiyanur series (Typic Haplustalf). The experiment includes eight treatments in which lignite humic acid was applied (through soil at 10 and 20 kg ha^{-1} and foliar spray at 0.1 % concentration) with the 75 and 100 per cent recommended dose of inorganic fertilizers. The results showed that combined application of recommended dose of inorganic fertilizers (60:60:30 kg NPK ha^{-1}) and lignite humic acid @ 20 kg per hectare significantly increased the plant height (49.5 cm), number of leaves per plant (47.2) and root length (11.2 cm) of onion. Combined application of lignite humic acid @ 20 kg ha^{-1} and recommended dose of inorganic fertilizers had conspicuously increased (11.31 %) the bulb yield of onion over inorganic fertilizers alone.

Key words: Bulb yield, Growth attributes, Lignite humic acid, Onion.

Onion is one of the most important commercial vegetable crops grown in India. The onion bulbs are rich in minerals like phosphorus, calcium and vitamin C. The pungency in onion is due to volatile oil (allyl - propyl disulphide) (Aykroyd, 1963). Being a shallow rooted crop, onion is considered as a surface feeder and so requires heavy dosage of nutrients. But the indiscriminate usage of chemical fertilizers has depleted the soil environment resulting in decrease of organic matter content, yield and quality of crops which necessitates to find out organic supplement sources for maintaining the soil fertility and to achieve the sustainable crop production. In this context, lignite humic acid an innovative product rich in organic nutrients obtained from Neyveli Lignite Corporation is known to promote growth and yield of crops. Laboratory experiments have shown that lower molecular weight substances from humic acid are taken up by the plants and influence metabolism (Khristeva *et al*., 1962). The present investigation was carried out with the objective of studying the effect of lignite humic acid and fertilizers on growth attributes and yield parameters of onion.

MATERIALS AND METHODS

A field experiment was conducted at TNAU, Coimbatore during *kharif* 2003 to study the effect of lignite humic acid (LHA) and fertilizers on growth and yield of onion. The soil of the experimental field was sandy clay loam in texture with pH 8.1 and EC 0.13 dS m^{-1}. The initial $KMnO_4$-N, Olsen-P and NH_4OAc-K status were 221, 12.40 and 253 kg ha^{-1}, respectively. Treatments consisted of control (T_1), 75% recommended dose of NPK (T_2), 100% recommended dose of NPK (T_3), 100% NPK + 10 kg humic acid ha^{-1} as soil application (T_4) 100% NPK + 20 kg humic acid ha^{-1} as soil application (T_5), 100% NPK + 0.1 % humic acid as foliar spray (T_6), 100% NPK + 10 kg humic acid ha^{-1} as soil application + 0.1 % humic acid as foliar spray (T_7) and 75% NPK + 10 kg humic acid ha^{-1} as soil application + 0.1 % humic acid as foliar spray (T_8), were replicated thrice and laid out in randomized block design.

As per the treatments, recommended dose of NPK fertilizers 60:60:30 kg NPK ha^{-1} (100%) and 45:45:22.5 kg NPK ha^{-1} (75%) were applied along the ridges (N, P and K were applied as urea, single super phosphate and muriate of potash, respectively). Among these, half dose of N and full dose of P and K were applied basally; remaining half dose of N was applied at 30 days after sowing. The lignite humic acid was applied basally in the treatments receiving soil application of humic acid by sand mix. The foliar application of 0.1% humic acid was done on 20^{th} and 40^{th} days after sowing by dissolving required quantity of potassium humate in water. The humic acid content of potassium humate obtained from Neyveli Lignite Corporation was 65 per cent. The net plot size of the experimental trial was 5X3 m and spacing adopted was 45X10 cm. Cultural operations like irrigation, weeding *etc* were done as and when required. At the time of harvest, data on growth attributes (plant height, number

of leaves per plant and root length) and yield attributes (number of bulbs per plant, bulb girth and bulb weight per plant) were recorded and the bulb yield was expressed in t ha^{-1}.

RESULTS AND DISCUSSION

Growth attributes of onion

The results revealed that all the growth attributes were significantly influenced by the application of lignite humic acid and inorganic fertilizers (Table 1). Among the treatments, 100 % NPK + 20 kg lignite humic acid ha^{-1} as soil application produced significantly taller plants (49.5 cm), more number of leaves per plant (47.2) and maximum root length (11.2 cm) at harvest as compared to other treatments. The increase in plant height due to the humic acid application might have attributed to the better rooting and absorption of nutrients by plants and also due to the auxin activity of humic acid on plant growth (O'Donnel, 1973; Fagbenro and Agboola, 1993). The very high ion exchange capacity of humic acid might have increased the availability of nutrients in the root zone leading to enhanced root length. Application of humic acid increased the N availability and uptake (Guminski, 1968), which is an important constituent of nucleic acids might have promoted cell division resulting in increased vegetative growth.

The maximum drymatter production (2110 kg ha^{-1}) by crop was recorded in the treatment receiving soil application of lignite humic acid @ 20 kg ha^{-1} plus 100% recommended dose of inorganic fertilizers. The enhanced and prolonged activity of IAA in plants was reported due to increased orthodihydroxy phenols in the presence of humic acid could have promoted the growth of plants resulting in higher drymatter production as suggested by Mato *et al*., (1971). Humic acid acts as a respiratory catalyst, and increases cell permeability and this might also have contributed to the increased drymatter production. This is in confirmity with earlier findings of Balasubramaniam *et al*. (2000).

Yield attributes and bulb yield of onion

Significant influence on yield parameters were observed due to addition of lignite humic acid and inorganic fertilizers (Table 2). Application of 100 % NPK plus 20 kg lignite humic acid ha^{-1} as soil application significantly produced the highest number of bulbs per plant (9.8) and maximum bulb girth (9.2 cm). Application of humic acid increases the nutrient availability in soil (Govindasamy *et al*., 1989), which might have improved the vegetative growth and accelerated the photosynthesis in plants and translocation of photosynthates in storage organ of bulb resulting in an increased diameter and weight of bulb.

The combined application of lignite humic acid @ 20 kg ha^{-1} with 100 per cent NPK increased the bulb yield (11.31 %) as compared to inorganic fertilizers alone. This might be due to the over all improvement of plant growth and allied increase in root biomass resulting in higher water and nutrient absorption. Associated with this improved water absorption and nutrient supply, transpiration might have lowered, causing more carbon dioxide availability through stomatal opening and ease the net increase in photosynthetic rate. A cumulative effect of all these factors might have resulted in total yield enhancement. This is in conformity with the findings of

Table 1 : Effect of treatments on growth attributes of onion

Treatments	Plant height (cm)	No. of leaves per plant	Root length (cm)	Dry matter production (kg ha^{-1})
T_1 - control	34.1	27.4	5.4	1445
T_2 - 75% NPK	41.6	34.2	7.5	1752
T_3 - 100% NPK	45.8	38.5	9.0	1941
T_4 - 100% NPK + 10 kg HA ha^{-1} SA	47.0	41.8	10.4	2040
T_5 - 100% NPK + 20 kg HA ha^{-1} SA	49.5	47.2	11.2	2110
T_6 -100% NPK + 0.1% HA FS	46.3	39.4	9.3	1967
T_7 - T_3 + 10 kg HA ha^{-1} SA + 0.1% HA FS	48.0	43.8	10.6	2070
T_8 - T_2 + 10 kg HA ha^{-1} SA + 0.1% HA FS	46.7	40.7	9.8	2017
SEd	2.0	2.6	0.4	36
CD (P = 0.05)	4.0	5.6	0.8	77

Table 2 : Effect of treatments on yield attributes and bulb yield of onion.

Treatments	No. of bulbs per plant	Bulb girth (cm)	Bulb yield (t ha^{-1})
T_1 - control	4.1	4.7	12.5
T_2 - 75% NPK	5.2	5.9	15.3
T_3 - 100% NPK	5.8	6.5	16.8
T_4 - 100% NPK + 10 kg HA ha^{-1} SA	8.4	7.8	17.8
T_5 - 100% NPK + 20 kg HA ha^{-1} SA	9.8	9.2	18.7
T_6 -100% NPK + 0.1% HA FS	6.3	6.7	17.0
T_7 - T_3 + 10 kg HA ha^{-1} SA + 0.1% HA FS	9.0	8.4	18.0
T_8 - T_2 + 10 kg HA ha^{-1} SA + 0.1% HA FS	7.5	7.2	17.6
SEd	0.3	0.5	0.3
CD (P = 0.05)	0.7	1.0	0.7

Sathiyabama and Selvakumari (2001).

Thus it is evident that combined application of lignite humic acid @ 20 kg ha^{-1} with recommended dose of NPK fertilizers (60:60:30 kg ha^{-1}) maximized the growth and yield attributes and finally yield of onion.

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