Influence of foliar spray of nutrients on crop performance and seed yield of lamb's quarters (*Chenopodium album* L)

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ABSTRACT

Lamb's quarters (*Chenopodium album* L) is a leafy vegetable that contains vitamins, essential oils, minerals and considerable amount of albuminoids. The crop is mainly propagated through seeds and, therefore, the quality of the seed is an important criterion to get a good crop growth and yield. Hence, an experiment was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu to assess the influence of foliar nutrition on crop growth and yield of lamb's quarters. Results showed that minimum days to 50 per cent flowering (50.0) were recorded in treatment DAP 2 per cent; maximum plant height was recorded in DAP 2 per cent (140.9 cm) and urea 1 per cent (134.4 cm) and higher total number of secondary branches per plant was recorded in DAP 2 per cent (86.0) and urea 1 per cent (78.3). Maximum seed yield per plant of 26.5 g, seed yield per plot of 1.75 kg and seed yield per ha of 1,948 kg were observed in DAP 2 per cent. DAP 2 per cent, urea 1 per cent and $ZnSO_4$ 0.5 per cent recorded highest 1,000-seed weight of 1.80, 1.78 and 1.74 g respectively.

Keywords: Lamb's quarters; foliar spray; plant growth; seed yield; seed quality

INTRODUCTION

Lamb's quarters (*Chenopodium album* L) is a minor leafy vegetable that belongs to the family Amaranthaceae. It is the fast growing annual plant, grown well in tropical and sub-tropical regions with soil rich in nitrogen. It is cultivated in wider range so its native is obscure. It was described by Linnaeus in 1753 from Europe. It is believed that lamb's quarters may be of European origin. This species has several sub-species, micro-species as well as varieties which cannot be differentiated easily. The crop is grown for various purposes like food, fodder and also for its medicinal purposes in Asian and African countries. In India, it is highly cultivated in northern region, where winter season is most suitable for it. However, in south India, the people consume it as leafy vegetable.

The crop has recently gained worldwide attention due to its nutritional value. Economically, the leaves and stems are used as vegetable, either raw or cooked and the tender leaves are used in many Indian dishes. Its seeds are also used as food material and it can be grown as a pseudo-cereal. In the Himalayan region, it is considered as an important subsidiary grain crop, as a pot herb for secondary fodder and salad dressings (Bhargava and Ohri 2007). The leaves are rich in vitamin A and C, essential oils, minerals particularly potash and considerable amount of albuminoids and nitrogen. The root contains saponin and two flavonoids viz kampferol and quercetin. Therefore, it is widely used in folk medicines around the world. Particularly, it is used in the treatment of rheumatism, bug bites, sun stroke, urinary problems, skin problems etc. Also, the plant has medicinal values like laxative property and acts as blood purifier and anti-ulcer agent (Sanwal 2008). Therefore, considering its importance and economical value, Tamil Nadu Agricultural University (TNAU) has released a variety of lamb's quarters (*Chakravarthi keerai*) named Ooty (Ck) 1. This variety is rich in protein (22%), zinc (23 ppm), calcium (0.84%), magnesium (0.58%) and iron (474 ppm).

The crop is mainly propagated through seeds. Seeds have to face a number of problems from

environmental, edaphic and biotic factors during their development and maturation stages and only those seeds, which overcome all these factors, reach the expected level of quality. Sometimes, the mother plant is unable to absorb nutrients from the soil due to non-availability of particular nutrients, problems in translocation of the nutrients and type of soil and weather conditions existing during absorption (Singh et al 1998). To mobilize such nutrients to the seed, foliar spraying is highly useful. Foliar nutrients generally penetrate the leaf cuticle or stomata and enter the cells enabling easy and rapid utilization of nutrients. Foliar spray acts as a nutritional boost at critical junctures of different phenophases, corrects deficiency disorders, increases plant mineral status and improves crop yield (Wittwer and Teubner 1959). Therefore, an attempt was made to assess the influence of foliar spraying of nutrients on the lamb's quarters var Ooty (Ck) 1 on its crop performance and seed yield.

MATERIAL and METHODS

Genetically pure seeds of lamb's quarters (*Chakravarthi keerai*) var Ooty (Ck) 1 were obtained from the Horticultural Research Station, Tamil Nadu Agricultural University, Ooty, the Nilgiris district, Tamil Nadu. The field experiment was conducted in randomized block design with three replications comprising plot size of 3 m x 3 m at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. The crop was maintained by all the recommended package of practices recommended by Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. The first foliar spray was given as per the treatments viz T_1: Control (no spray), T_2: Water spray, T_3: Urea 1 per cent, T_4: DAP 2 per cent, T_5: ZnSO4 0.5 per cent, T_6: $ZnSO_4$ 1.0 per cent, T_7: Borax 0.5 per cent and T_8: Borax 1.0 per cent at 45 days after sowing (DAS) and the second spray at 10 days after the first spraying ie after 55 DAS. The plant morphological traits viz flowering behaviour, seed yield and seed traits were recorded in 10 randomly selected plants from all the treatments. Mean data were derived and subjected to statistical analysis (Panse and Sukhatme 1985).

RESULTS and DISCUSSION

The data given in Table 1 show that minimum days to 50 per cent flowering (50.0) were recorded in treatment T_4 (DAP 2%) followed by 52.3 in T_3 (Urea 1%) and maximum 63.0 and 62.3 in T_1 (Control) and T_2 (Water spray) respectively, the latter two being statistically at par. Maximum plant height was recorded in T_4 (140.9 cm) and T_3 (134.4 cm), which were at par and T_3, on the other hand, was at par with T_5 ($ZnSO_4$ 0.5%), T_6 ($ZnSO_4$ 1%), T_7 (Borax 0.5%) and T_8 (Borax 1%) with plant height of 128.4, 130.6, 128.3 and 131.0 cm respectively. Minimum plant height was exhibited by T_1 (123.3 cm), T_2 (123.7 cm), T_5, T_6, T_7 and T_8, all being at par. Maximum total number of primary branches per plant was recorded in T_4 (18.6), T_3 (15.6) and T_8 (14.3), which were at par, as compared to minimum in T_1 (12.0) and T_2 (12.3), the two being at par. Higher total number of secondary branches per plant was recorded in T_4 (86.0) and T_3 (78.3), the two being at par, as compared to T_1 (60.0), T_2 (61.6), T_5 (63.3), T_6 (66.6), T_7 (65.0) and T_8 (71.6), all being at par. Higher length of main inflorescence was recorded in T_4 (48.2 cm), T_3 (43.5 cm), T_8 (43.3 cm) and T_6 (42.7 cm), all being at par, as compared to lower length of main inflorescence recorded in T_1 (35.3 cm), T_2 (38.2 cm), T_5 (41.6 cm) and T_7 (41.6 cm), the four being at par.

Pandian et al (2001) studied the influence of various methods of sowing, stubble management and nutrient application on rice fallow green gram and found that the treatment consisting of dibbling green gram seeds as rice fallow in rice stubbles immediately after the harvest of the rice with stubbles cut and mulched over soil along with basal N and P application of 12.5:25 kg per ha and two per cent DAP spray twice, produced higher green gram yield of 691 kg per ha which accounted for 165 per cent increased yield over conventional method of raising rice fallow pulses. Kumar et al (2008) studied the effect of different levels of phosphorus in the form of DAP in integration with four levels of sulphur on groundnut and concluded that application of 60 kg P_2O_5 per ha proved beneficial in increasing growth characters, yield attributes, yield of kernel and uptake of N, P, K and S and micronutrients like, Fe, Mn, Zn and Cu. Dalei et al (2014) revealed that foliar application of urea and DAP gave better performance regarding growth and yield attributes of niger. Highest seed yield (417.2 kg/ha) was recorded with application of 100 per cent RDF + foliar application of 2 per cent urea twice at flowering and capitula formation stage.

Highest plant height and more number of branches in lamb's quarters might be due to better availability of nitrogen and phosphorus which play a vital role in cell division (Dalei et al 2014). Also, DAP

Table 1. Effect of nutrient foliar spray on plant growth and seed yield in lamb's quarters (*Chakravarthi keerai*) var Ooty (Ck) 1

Treatment	Days to 50% flowering	Plant height (cm)	Total number of primary branches/plant	Total number of secondary branches/plant	Length of main inflorescence (cm)	Seed yield/plant (g)	Seed yield/plot (kg)	Seed yield/ha (kg)	1,000-seed weight (g)
T_1 (Control)	63.0	123.3	12.0 (3.46)	60.0 (7.74)	35.3	18.0	1.19	1,322	1.60
T_2 (Water spray)	62.3	123.7	12.3 (3.51)	61.6 (7.85)	38.2	17.9	1.18	1,318	1.65
T_3 (Urea 1%)	52.3	134.4	15.6 (3.95)	78.3 (8.85)	43.5	23.9	1.57	1,755	1.78
T_4 (DAP 2%)	50.0	140.9	18.6 (4.32)	86.0 (9.27)	48.2	26.5	1.75	1,948	1.80
T_5 ($ZnSO_4$ 0.5%)	58.6	128.4	12.7 (3.55)	63.3 (7.95)	41.6	20.0	1.32	1,472	1.74
T_6 ($ZnSO_4$ 1%)	56.6	130.6	13.3 (3.65)	66.6 (8.16)	42.7	20.9	1.38	1,538	1.70
T_7 (Borax 0.5%)	56.3	128.3	13.0 (3.60)	65.0 (8.06)	41.6	20.6	1.36	1,513	1.73
T_8 (Borax 1%)	55.3	131.0	14.3 (3.78)	71.6 (8.46)	43.3	21.6	1.43	1,589	1.72
SEd	0.7	4.1	0.3	0.5	3.0	0.9	0.06	68.6	0.03
$CD_{0.05}$	1.4	8.8	0.6	1.0	6.5	2.0	0.13	147.2	0.06

Figures in parentheses are square root transformed values

contains nitrogen and phosphorous and their role in increasing the products of photosynthesis and their transfer to grains reflected positively on the characteristics of the yield (Saleque et al 2004, Al-Khuzai and Al-Juthery 2020). They reported that the foliar application of nitrogen through DAP produced higher chlorophyll content. This increased chlorophyll content in leaves could be attributed to greater availability of nitrogen for the formation of chlorophyll, which in turn increased the rate of photosynthesis and resulted in greater production and accumulation of total dry matter.

Maximum seed yield per plant of 26.5 g was observed in T_4 followed by T_3 (23.9 g) and the minimum in T_2 (17.9 g) and T_1 (18.0 g), which were at par. Maximum seed yield per plot of 1.75 kg was observed in T_4 followed by T_3 (1.57 kg) and the minimum in T_2 (1.18 kg) and T_1 (1.19 kg), which were at par. Maximum seed yield per ha of 1,948 kg was observed in T_4 followed by T_3 (1,755 kg) and the minimum in T_2 (1,318 kg) and T_1 (1,322 kg), which were at par. T_4, T_3 and T_5 recorded highest 1,000-seed weight of 1.80, 1.78 and 1.74 g respectively, which were at par, as compared to lowest of 1.60 and 1.65 g in T_1 and T_2 respectively, the two being at par.

Kumar et al (2013) revealed that foliar spray of 2 per cent DAP twice at flower initiation and pod formation stages of soybean crop growth resulted in significantly higher number of pods per plant (62.50), number of seeds per pod, seed index and higher grain yield (1,460 kg/ha). It was on par with 2 per cent urea phosphate. Patil et al (2014) found that application of 40 kg phosphorus per ha recorded highest values of all the growth characters and yield contributing characters of linseed. Foliar sprays of 2 per cent DAP at flowering and capsule development recorded significantly higher grain yield with improved growth parameters.

The occurrence of highest number of primary and secondary branches leads to increased seed yield. Also, better plant growth and development could be due to rapid and timely availability of nutrients and increased plant metabolic activity for yield improved in lamb's quarters. Similar results were reported in green gram (Rajendran 1991). Similarly, foliar spraying of DAP facilitates the quick absorption of nitrogen and phosphorus at the time of flowering where the nutrient demand is at the peak. In addition, it reduces the flower drop due to prolonged assimilatory activity of leaves and increased production of dry matter and its efficient

translocation of photosynthates from source to sink which results in higher seed yield (Dalei et al 2014, Thakur et al 2017).

CONCLUSION

It can be concluded that minimum days to 50 per cent flowering (50.0) were recorded in treatment DAP 2 per cent followed by 52.3 in urea 1 per cent, maximum plant height was recorded in DAP 2 per cent (140.9 cm) and urea 1 per cent (134.4 cm) which were at par. Higher total number of secondary branches per plant was recorded in DAP 2 per cent (86.0) and urea 1 per cent (78.3). Maximum seed yield per plant of 26.5 g was observed in DAP 2 per cent followed by urea 1 per cent (23.9 g). Maximum seed yield per plot of 1.75 kg was observed in DAP 2 per cent followed by urea 1 per cent (1.57 kg). Maximum seed yield per ha of 1,948 kg was observed in DAP 2 per cent followed by urea 1 per cent (1,755 kg). These two treatments along with $ZnSO_4$ 0.5 per cent also recorded highest 1,000-seed weight of 1.80, 1.78 and 1.74 g respectively.

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