

MANAGEMENT OF TIP BURN OF GARLIC

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ABSTRACT

The experiment was conducted at Agriculture Research Station, BARI, Bogura during 2019-20 and 2020-21 regarding management of tip burn, a leaf blight disease of garlic. Tip burn is a common phenomenon in garlic plants. The study comprised 10 treatments i.e., T₁= Five irrigation at an interval of 15 days starting after emergence, T₂= Soil amendment with ash 2.0 t ha⁻¹, T₃= Soil amendment with boron @ 2 kg ha⁻¹, T₄= Five times foliar spraying with boric acid @ 3 g L⁻¹ at an interval of 15 days starting after emergence at 3-4 leaf stage, T₅= Soil amendment with Zn @ 3 kg ha⁻¹, T₆= Foliar spray of Potassium sulphate (K₂SO₄) @ 5 g L⁻¹ twice at fortnightly interval at 3-4 leaf stage, T₇= Foliar spray of Calcium sulphate (CaSO₄) @ 5 g L⁻¹ twice at fortnightly interval at 3-4 leaf stage, T₈= Amistar top @ 1 mL⁻¹ of water, T₉= Nutraphos-N 3 times foliar spraying @ 4 g L⁻¹ at an interval of 15 days starting at 3-4 leaf stage and T₁₀ = Control were employed in the experiment. The tip burn incidence varied with the different management approaches ranging from 75.32 - 90.54% in 2019-20 and 85.15-97.38% in 2020-21 cropping season. The application of ash, soil amendment with Zn, timely irrigation schedule, application of K₂SO₄ and CaSO₄, spraying with fungicide like Amistar top and Nutraphos-N3 were seemingly helpful for slightly reduction in burning of the tips of garlic plants as compared to no spray (control) condition. However, the highest tip burn incidence was obtained from T₁₀ (Control) treatment and the lowest incidence was obtained from T₈ (Amistar Top @ 1 mL⁻¹ of water) and T₉ (Nutraphos-N 3 times foliar spraying @ 4 g L⁻¹). Boron application either in soil or by spray as Solubor has no effect on reducing burning incidence. More burning resulted in reduction of bulb yield of garlic and vice versa. Yield varied from 7.77-10.42 t/ha in 2019-20 and from 6.72-7.53 t/ha in 2020-21. The highest yield was recorded in T₉ and T₈ which are statistically identical to the yield secured from other treatments except T₁₀ (control). Higher bulb yield contributed to the higher gross return and gross margin. Maximum gross return and gross margin was recorded from T₉ treatment followed by T₈ and the minimum from T₁₀ treatment.

Key words: Tip burn, Nutrient management, garlic.

Introduction

Garlic (*Allium sativum* L) is one of the most important bulb crops commercially grown in all parts of the country. It is an indispensable component in our daily life, mostly in the kitchen. It has medicinal value also. The total production area was 60776 ha and the total production was 381851 metric tons with an average yield of 6.28 metric tons per hectare in Bangladesh (BBS, 2018). The average yield of garlic in our country is very low compared to other garlic growing countries in the world. This is due to various disease-insect especially tip burn (physiological disorder) and lack of developed production technology (Bisht *et al.*, 1993, Dordas, 2009 and Mishra *et al.*, 2009). But very little effort was given for the management of tip burn in Bangladesh. Researchers of different parts of the world reported that water shortage, potassium scarcity and micronutrient limitation may cause tip burn in garlic (Dordas, 2009 and Mishra *et al.*, 2009). It may also cause by primary or secondary infection of fungus (Oboron *et al.*, 2003). Considering the above fact, the present study was undertaken to find out the effective control measures of tip burn for increasing the garlic production of Bangladesh.

Materials and Methods

The experiment was conducted for the two consecutive years at Agriculture Research Station, BARI, Bogura during 2019-20 and 2020-21 cropping seasons to observe the efficacy of different management options on controlling tip burn of garlic. The land was medium high land, and the soil was loam in texture. The experimental plot was prepared with five plowing and cross ploughings followed by laddering to break

the clods as well as to level the soil. Ten treatments were arranged in Randomized Complete Block Design with three replications. The treatment were T₁= Five irrigation at an interval of 15 days starting after emergence, T₂= Soil amendment with ash 2.0 tha⁻¹, T₃= Soil amendment with boron @ 2 kgha⁻¹, T₄= Five times foliar spraying with boric acid @ 3 gL⁻¹ at an interval of 15 days starting after emergence at 3-4 leaf stage, T₅= Soil amendment with Zn @ 3 kgha⁻¹, T₆= Foliar spray of Potassium sulphate (K₂SO₄) @ 5 gL⁻¹ twice at fortnightly interval at 3-4 leaf stage, T₇= Foliar spray of Calcium sulphate (CaSO₄) @ 5 gL⁻¹ twice at fortnightly interval at 3-4 leaf stage, T₈= Amister top @ 1 mL⁻¹ of water, T₉= Nutraphos-N 3 times foliar spraying @ 4 gL⁻¹ at an interval of 15 days starting at 3-4 leaf stage and T₁₀ = Control. The entire quantity of cow dung, TSP, Gypsum, half Urea & half MoP will be applied at the time of final land preparation. Rest Urea & MoP will be applied in two equal installments at 25 and 50 DAS. BARI Rashun-1 was used in this experiment. Planting was done on 23-27 November 2019 and 2020 maintaining 15cm × 10cm spacing. The unit plot size was 2.5 m × 4 m. To control Thrips infestation, the crop was sprayed with Gain-20 (imidacloprid) @ 0.5ml per liter of water for three times at 30, 45, and 80 DAS. A sticky substance like shampoo was used with insecticide and fungicide. Three weddings were done at 25, 50 & 75 days after planting. During the growing period, the plots were inspected regularly to record all the incidence of tip burn from seedling to maturity stage of the crop. The crop was harvested on March 18 2020 and March 26, 2021, respectively. Data were recorded on plant height, the incidence of tip burn, number of cloves per bulb, the weight of single bulb, and yield. The collected data were statistical analysis by Statistix-10 package software and mean values were separated.

Results and Discussion

Effect of treatments on tip burn of garlic: Results of the effect of treatments on tip burn of garlic are presented in Table 1. Treatments showed a significant effect of tip burn of garlic. The tip burn incidence varied with the different management approaches ranging from 75.32 -90.54% in 2019-20 and 85.15-97.38% in 2020-21 cropping season. The application of ash, soil amendment with Zn, timely irrigation schedule, application of K₂SO₄ and CaSO₄, spraying with fungicide like Amister top and Nutraphos-N were seemingly helpful for slightly reduction in burning of the tips of garlic plants as compared to no spray (control) condition. However, the highest tip burn incidence was obtained from T₁₀ (Control) treatment and the lowest incidence was obtained from T₈ (Amistar Top @ 1 mL⁻¹ of water) and T₉ (Nutraphos-N 3 times foliar spraying @ 4 gL⁻¹). Boron application either in soil or by spray as Solubor has little or no effect on reducing burning incidence.

Table 1. Effect of treatments on tip burn of garlic during 2019-20 and 2020-21 cropping season

Treatment	Tip burn incidence (%)	
	2019-20	2020-21
T ₁	83.37 bc	94.33 abc
T ₂	81.69 bc	93.41 bcd
T ₃	85.16 b	96.23 ab
T ₄	85.78 b	97.33 a
T ₅	80.45 c	90.67 de
T ₆	78.33 cd	92.67 cd
T ₇	77.67 cd	95.47 abc
T ₈	76.67 d	87.25 f
T ₉	75.32 d	85.15 f
T ₁₀	90.54 a	97.38 a
CV (%)	3.76	4.39

*In a column, similar letter(s) do not differ significantly at 5% level of probability.

Effect of treatments on morphological, yield and yield attributes of garlic: Morphological, yield and yield contributing characters presented in the Tables 2-3. Plant height was varied non-significantly among

the treatments ranging from 68.37 cm to 73.03 cm in 2019-20 and 56.4 cm to 63.27 cm in 2020-21 season. Plant height was slightly higher in 2019-20 than that of 2020-21 might be due to the prolong favourable winter season prevailed in the former year in comparison to later one. Although the plant height was not differed significantly, however, numerically higher plant height was recorded from T₉ (Nutraphos-N 3 times foliar spraying @ 4 gL⁻¹) and lower from T₁₀ (Control) treatment in both the years.

Plant population was statistically identical among the treatments ranging from 65.08 to 67.12 in 2019-20 and 58.49 to 63.45 in 2020-21 cropping year. The highest number of cloves per bulb and single bulb weight were obtained from T₉ treatment followed by T₈ treatment, but the control treatment resulted in the lower number of respective parameters with which burning incidence was the maximum. Yield varied from 7.77-10.42 t/ha in 2019-20 and from 6.72-7.53 t/ha in 2020-21. The highest yield was recorded in T₉ and T₈ which are statistically identical to the yield secured from other treatments except T₁₀ (control). The more burning in the leaves, the less green area for photosynthesis consequently resulted in less photosynthate production in plants which ultimately forced to minimum yield of garlic in the respective treatment from those in which burning in minimum. Similar observation by Faruk, 2022 that soil and foliar application of plant nutrients viz. Potassium, Phosphorus, Boron, Zinc, Calcium, Copper, Silicon and Manganese gave appreciable reduction of purple blotch disease and tip-burn incidence and increased plant growth parameters such as shoot and root growth as well as yield of garlic. Agrios (2005) reported that plant nutrients are important for growth and development of plants and also microorganisms and also important factors in disease control.

Table 2. Effect of treatments on yield and yield attributes of garlic

Treatment	Plant height (cm)		Plant population/m ²		No. of cloves/bulb	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T ₁	71.90 ab	60.13 ab	66.67 ab	61.26 ab	21.13 b	16.8 b
T ₂	72.87 ab	62.4 a	66.38 ab	61.52 ab	22.8 ab	17.4 ab
T ₃	69.50 ab	58.47 ab	64.43 b	58.49 c	20.67 bc	16.47 b
T ₄	70.03 ab	58.67 ab	65.18 b	60.63 b	22.27 ab	17.2 ab
T ₅	70.57 ab	59.8 ab	66.85 ab	61.35 ab	23.47 ab	17.87 ab
T ₆	73.03 a	63.27 a	67.12 ab	62.78 a	20.73 bc	16.93 ab
T ₇	70.50 ab	58.4 ab	65.33 b	59.27 bc	22.07 ab	17.27 ab
T ₈	71.57 ab	60.93 ab	66.67 ab	61.18 ab	24.67 a	18.27 ab
T ₉	72.20 ab	61.6 a	68.67 a	63.45 a	24.93 a	19.4 a
T ₁₀	68.37 b	56.4 b	65.08 b	60.98 b	18.23 c	16.4 b
CV (%)	3.78	4.95	9.58	8.46	6.47	10.54

Table 3. Effect of treatments on yield and yield attributes of garlic

Treatment	Individual bulb weight (g)		Bulb yield (tha ⁻¹)	
	2019-20	2020-21	2019-20	2020-21
T ₁	28.25 bc	25.14 ab	8.93 bc	7.23 ab
T ₂	28.36 bc	25.25 ab	10.11 ab	7.30 a
T ₃	28.15 bc	24.05 ab	9.08 abc	7.15 ab
T ₄	27.46 cd	25.10 ab	9.44 ab	7.20 ab
T ₅	29.23 bc	25.32 ab	10.07 ab	7.13 ab
T ₆	31.46 ab	25.41 ab	10.35 ab	7.40 a
T ₇	29.14 bc	24.11 bc	10.25 ab	7.33 a
T ₈	32.8 ab	25.65 ab	10.40 a	7.50 a
T ₉	33.18 a	26.86 a	10.42 a	7.53 b
T ₁₀	26.16 d	22 c	7.77 c	6.72 c
CV (%)	2.39	3.37	4.53	2.58

*In a column, similar letter(s) do not differ significantly at 5% level of probability.

Cost and return analysis of garlic: Cost and return related information against different treatments presented in the Table 4. Gross return was amounted based on average bulb yield of garlic during 2019-20 and 2020-21 seasons. Maximum yield resulted in higher gross return as well as gross margin against the cultivation cost. The higher gross margin 718000 Tk.ha⁻¹ was obtained from T₉ which was followed by T₈ and the lowest gross margin 579600 Tk.ha⁻¹ was obtained from T₁₀ treatment. Higher gross return contributed to the higher gross margin 452260 Tk.ha⁻¹ in T₉ and lower gross return secured lower gross margin in T₁₀. The lowest gross margin was 313710 Tk.ha⁻¹.

Table 4. Cost and return analysis of garlic by using different treatment

Treatment	Average yield (tha ⁻¹)	Gross return (Tk.ha ⁻¹)	Total variable cost (Tk.ha ⁻¹)	Gross margin (Tk.ha ⁻¹)
T ₁	8.08	646400	265410	380990
T ₂	8.71	696400	265680	430720
T ₃	8.12	649200	265750	383450
T ₄	8.32	665600	265310	400290
T ₅	8.60	688000	265010	422990
T ₆	8.88	710000	265630	444370
T ₇	8.79	703200	265320	437880
T ₈	8.95	716000	265480	450520
T ₉	8.98	718000	265740	452260
T ₁₀	7.25	579600	265890	313710

Urea-Tk. 18/kg, TSP-Tk. 22/kg, MoP-Tk. 18/kg, Clove-140 Tk/kg, Garlic Sale Price-Tk. 70/kg bulb

Conclusion

From the above study, it may be concluded that the higher tip burn incidence resulted in lower yield as compared to the plants which have minimum burning. Application of ash, timely spraying with fungicides like Amister top and Nutraphos-N could be the good options for effectively minimizing the tip burn incidence.

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