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EFFECT OF FOLIAR NITROGEN FERTILIZATION ON COTTON SEED YIELD AND QUALITY

Foliar spray:

Foliar fertilization is a widely used method used to supplement soil applications to improve the yield and quality of field crops. The practice of foliar feeding with plant nutrients gives quick benefits and economizes nutrient element as compared to soil application. Foliar feeding is often effective when roots are unable to absorb sufficient nutrients from the soil due to a high degree of fixation, losses from leaching, low soil temperature and lack of soil moisture.

Foliar fertilization in cotton is advantageous over traditional soil fertilization because of:

(i) plant with heavy boll load accompanied by a decline in the active root system,

(ii) plant response is fast and therefore deficiencies may be rectified quickly,

(iii) no soil fixation,

(iv) independent of root uptake and so be applied when root functioning is declining or impaired and

(v) temporary shortage of soil moisture that limit soil nutrient diffusion

OBJECTIVE

- To determine the correct concentration level of foliar nitrogen for maximizing growth, yield, fibre and seed quality of cotton

MATERIALS AND METHODS

Location:

Field experiment: carried out at Central Cotton Research Farm, Sreepur, Gazipur

Laboratory experiment: carried out at Seed Science & Technology lab. BSMRAU, Gazipur,

Treatments:

Factor A: Variety - CB-10 was used

Factor B: 08 level of Nitrogen(%) - 0, 4.5, 6.0, 7.5, 9.0, 10.5, 12 and 13.5 g N L^{-1} water

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Table 1.1. Physical and chemical properties of the soil of experimental field.

Soil properties	Analytical value
Sand (%)	40.53
Silt (%)	30.25
Clay (%)	29.22
Textural class	Clay loam
P^H	6.8
Organic Carbon (%)	0.67
Organic matter (%)	1.54
Total nitrogen (%)	0.06
Available phosphorus (ppm)	17
Exchangeable K (meq/100 gm soil)	0.16
Available sulphur (ppm)	2.5

Design:

Randomized Completely Block design with three replications

Data Collection

- No. of monopodial branch
- No. of sympodial branch
- Boll number
- Boll weight (g)
- Seed index (g)
- Ginning outturn (percentage)
- Seed cotton yield (t ha^{-1})
- Fibre Quality
- Germination test
- Electrical conductivity
- Oil content estimation
- Nitrogen estimation

Data Recording

Monopodial branch count:

The branch which vegetative branches are similar to the mainstream in that the primary axis continues to grow from the same growth point was considered as monopodial branch. Such branches were counted from five randomly tagged plants before the commencement of picking. The average number was computed and expressed as number of monopodial branches per plant.

Sympodial branch count:

Fruiting branches arising on the main stem and above the monopodial branches were counted just before the commencement of picking in five randomly selected plants. The average value was recorded as number of sympodial branches per plant

Boll number

The fully opened crossed bolls bearing white cotton thread were counted from the eighteen randomly selected plants and the mean value was recorded as the number of bolls per plant.

Boll weight (g)

Boll weight is the most important yield component after bolls per plant and has a great contribution in enhancement of yield. About 10 bolls were selected at random from each treatment replication wise. The seed cotton was separated from each boll and weighed separately. The average boll weight was computed and expressed in grams.

Seed index (g)

One hundred sound and mature seeds were manually counted and weighed from each treatment and replication wise. The average weight was recorded in grams as 100 seed weight.

Ginning outturn (percentage)

Ginning percentage was calculated by using the following formula given by Santhanam (1976).

$$\text{Ginning outturn} = \frac{\text{weight of lint (g)}}{\text{weight of seed cotton (g)}} \times 100$$

Seed cotton yield

The seed cotton yield (Kg ha^{-1}) was calculated by using the seed cotton yield obtained from the net plot area and care was taken to add the seed cotton weight of the five separately harvested plants, which were used for recording the growth and yield attributes.

Fibre Quality

Fibre length: Fibre length was measured by Fibrograph.

Microniare value: Micronaire value (Fitness of fibre) was determined by Micronaire testing instrument.

Fibre strength (PSI): Fibre strength was evaluated by Pressley Fiber Strength Tester.

Germination percentage (%)

Germination percentage was calculated using the following formula (Krishnasamy and Seshu, 1990).

$$\text{Germination (\%)} = \frac{\text{Number of seed germinated}}{\text{Number of seed tested}} \times 100$$

Electrical conductivity

Five grams seeds cotton were surface sterilized by using one per cent mercuric chloride solution and washed thrice with distilled water. Then 25 ml distilled water was added to the seeds and kept in an incubator maintained at 25 ^{o}C. After 24 hours of soaking, the solution was decanted and the volume of the decanted solution was made up to 25 ml by adding distilled water. The electrical conductivity of the seed leachate was recorded by using the electrical conductivity bridge and was expressed as dSm^{-1} (Presley, 1958).

Oil content estimation

The oil percentage of seed was estimated according to Gadgil *et al*. (1980) from moisture free seed meal by solvent extraction using other petroleum either (boiling point 60 ^{0}C to 80 ^{0}C) in a Soxhlet apparatus for eight hours. The meal was pre-dried at 60 ^{0}C for 24 hours. Two grams of meal was used for the estimation oil. No further oil was recovered from the residue after eight hours of refluxing.

Nitrogen estimation

Nitrogen percentage of cotton seed was estimated by Kjeldahl method. The estimated result was multiplied by the factor 6.25 to obtained protein percent.

RESULTS AND DISCUSSION

Table 1.2. Effect of foliar N fertilization on growth attributes of cotton

Foliar nitrogen levels (g L^{-1} water)	Plant height (cm)	Branch $plant^{-1}$	
		Monopodial	Sympodial
0	78.50 c	1.55	11.45
4.5	82.58 bc	1.75	11.42
6.0	83.58 abc	1.58	11.83
7.5	88.08 ab	1.93	12.92
9.0	90.35 a	2.17	12.00
10.5	85.92 ab	1.83	12.00
12.0	84.50 abc	2.33	12.02
13.5	84.17 abc	2.00	12.42
CV (%)	4.36	17.02	7.92

Mean followed by same latter(s) in a column are not significantly different by DMRT

Table. 1.3 Effect of foliar application of N on yield component, and yield of cotton

Foliar nitrogen levels (g L^{-1} water)	Boll $plant^{-1}$	Boll weight (g)	Seed cotton yield (t ha^{-1})	Ginning outturn (%)	Lint yield (t ha^{-1})	Seed yield (t ha^{-1})
0	15.62 c	4.84 bc	0.941 c	38.15	0.359 c	0.582 c
4.5	17.43 bc	4.47 cd	0.996 bc	41.37	0.412 bc	0.584 c
6.0	18.30 bc	4.22 de	1.099 abc	40.04	0.440 ab	0.658 bc
7.5	19.08 b	3.86 e	1.204 a	37.21	0.448 ab	0.755 ab
9.0	22.35 a	5.33 a	1.292 a	37.46	0.484 a	0.808 a
10.5	17.92 bc	5.05 ab	1.239 a	37.45	0.464 ab	0.775 ab
12.0	17.02 bc	5.00 ab	1.156 ab	37.63	0.435 ab	0.722 ab
13.5	16.85 bc	4.87 abc	1.121 abc	38.00	0.426 ab	0.695 abc
CV (%)	9.49	5.28	9.00	7.23	7.01	9.71

Mean followed by same latter(s) in a column are not significantly different by DMRT

Table. 1.4 Effect of foliar application of N on span length, uniformity ratio, pressly strength and micronair value

Foliar nitrogen levels (g L^{-1} water)	50% Span length (mm)	Uniformity ratio	Pressly strength (PSI)	Micronair value
0	11.45 c	41.00 d	81.35	4.00 d
4.5	11.94 bc	41.50 cd	83.42	4.05 cd
6.0	11.94 bc	43.83 b	82.08	4.30 bc
7.5	11.94 bc	44.17 b	83.42	4.35 b
9.0	12.19 a	46.83 a	83.92	4.60 a
10.5	11. 94 bc	43.33 bc	82.88	4.25 bcd
12.0	11.68 bc	42.67 bcd	84.04	4.30 bc
13.5	11.68 bc	42.50 bcd	82.89	4.23 bcd
CV (%)	7.29	2.69	1.60	3.20

Mean followed by same latter(s) in a column are not significantly different by DMRT

Table. 1.5. Effect of Foliar application of N on 100 seed weight , moisture content and electrical conductivity

Foliar nitrogen levels (g L^{-1} water)	100 seed weight (g)	Germination (%)	Shoot Length (cm)	Root Length (cm)	Electrical conductivity (µS $cm^{-1}g^{-1}$)
0	9.15 d	85.0 c	9.00 b	10.20	146.50 a
4.5	9.15 d	86.0 c	10.23 ab	10.27	123.33 b
6.0	9.26 cd	86.0 bc	10.60 a	10.40	118.83 bc
7.5	9.62 bc	86.0 c	10.93 a	10.47	115.67 bc
9.0	10.10 a	90.0 a	11.63 a	10.77	108.67 c
10.5	9.92 ab	89.0 a	10.53 a	10.60	116.50 bc
12.0	9.74 ab	88.0 ab	10.73 a	10.13	121.00 bc
13.5	9.63 bc	87.0 ab	10.43 a	10.00	120.17 bc
CV (%)	2.45	6.34	7.22	7.43	7.26

Mean followed by same latter(s) in a column are not significantly different by DMRT

1.6. Effect of foliar application of N on protein and oil content of cotton seed

Foliar nitrogen levels (g L^{-1} water)	Protein content (%)	Oil content (%)
0	17.98 c	18.71
4.5	19.31 b	19.01
6.0	19.81 ab	19.65
7.5	19.82 ab	19.74
9.0	20.33 ab	20.04
10.5	20.48 a	20.00
12.0	19.96 ab	19.60
13.5	19.82 ab	19.24
CV (%)	2.83	2.82

Mean followed by same latter(s) in a column are not significantly different by DMRT

Conclusions

- **Foliar fertilization with N can be increased plant height with the increased of foliar nitrogen levels.**

- **The foliar N fertilization supplements soil application for a more efficient supply of nutrients to the developing cotton plants for optimum yield, and fibre and seed quality.**

- **Foliar N fertilization is more effective if it is applied to cotton beginning at first flower, at ten days intervals, to increase yield or to prevent yield and quality losses associated with N deficiencies.**

- **In this study, foliar applying 9.0 N L^{-1} water increased yield, fibre properties and seed quality of cotton.**

Recommendations:

- **Foliar applications should be made either at early morning or late evening for maximum efficiency, and no foliar applications should be made at mid-day and to water stressed plants.**

- **Excessive application of N may also cause leaf burn and decrease yield and quality significantly.**

- **Further research into N accumulation in bolls, over developments stages may enhance the effectiveness of foliar N fertilization and the ability of growers to apply timely and appropriate quantities of for growth, yield and quality benefits.**


THANKS TO ALL