

## Effect of nitrogen, chlormequat chloride and farmyard manure applied to cotton (*Gossypium hirsutum*) and their residual effect on succeeding wheat (*Triticum aestivum*) crop

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### ABSTRACT

A field experiment was conducted during the rainy (*kharif*) and winter (*rabi*) seasons of 1994–95 and 1995–96 at New Delhi, to study the effect of nitrogen, chlormequat chloride and FYM applied to cotton (*Gossypium hirsutum* L.) and their residual effect on succeeding wheat (*Triticum aestivum* L. emend. Fiori & Paol.) crop. The treatment comprised 2 levels of FYM (0 and 10 tonnes/ha), 3 of nitrogen (0, 50 and 100 kg N/ha) and 3 of chlormequat chloride (0, 50 and 100 ppm). Results showed that FYM @ 10 tonnes/ha gave significantly more bolls/plant, higher boll weight and seed-cotton yield than that of no FYM. Nitrogen application significantly increased bolls/plant, boll weight, seed-cotton yield and N uptake over the control. Spraying 50 ppm chlormequat chloride gave significantly more bolls/plant, boll weight and seed-cotton yield than those of 0 and 100 ppm. The FYM left the highest residual effect on succeeding wheat crop. The highest net returns in cotton–wheat system was registered with FYM @ 10 tonnes/ha, followed by 100 kg N/ha and chlormequat chloride @ 50 ppm.

**Key words :** Cotton–wheat system, N, Chlormequat chloride, FYM, Net returns

Low productivity of cotton is largely attributed to excessive vegetative growth and boll shedding, imbalanced use of organic and inorganic fertilizers and poor agronomic practices of this crop. There is need of efficient utilization of the applied fertilizers for increasing yield and quality of farm produce. High prices and low supply of nitrogenous fertilizers necessitates organic manure to substitute inorganic nitrogen for greater stability and

sustainability in the crop production. The fertilizer applied to preceding cotton crop might leave some residual effect and thus change nutrient requirement of wheat crop (Kairon *et al.*, 1996). Excessive vegetative growth and boll shedding in cotton necessitates growth retardant (Marani *et al.*, 1973).

Chlormequat chloride possesses growth-retarding effect that results in more diversion of biological yield into economic

sink. Delayed senescence thus helps in increasing photosynthesis and mobilization of photosynthates to reproductive sink (Dong and Artica, 1982). The yield potential can be exploited by adopting improved package of practices along with suitable crop variety, cultural manipulation and judicious use of fertilizers. This practice of double cropping system is helpful for increasing the fibre as well as food production in the country.

The present study was therefore taken up to study the effect of nitrogen, chlormequat chloride and FYM applied to cotton and their residual effect on succeeding wheat crop.

#### MATERIALS AND METHODS

The experiment was carried out at the Research Farm of the Indian Agricultural Research Institute, New Delhi, during 1994-95 and 1995-96. The soil was sandy loam, low in organic carbon (0.38%), available N (200 kg/ha), medium in available P (21.8 kg/ha) and available K (225.5 kg/ha), with pH 8.0. Cotton cultivar 'Pusa 8-6' was sown in the last week of May with spacing of 75 cm × 30 cm. The treatments included 3 levels of nitrogen (0, 50 and 100 kg/ha), 3 levels of chlormequat chloride (0, 50 and 100 ppm) and 2 levels of farmyard manure (FYM) (0 and 10 tonnes/ha). Half of the N as urea, full FYM @ 10 tonnes/ha, P and K were applied at the time of sowing as basal. Chlormequat chloride and remaining half N were applied at square-initiation stage.

The experiment was laid out in split-plot design in 3 replications. Adequate plant-protection measures were taken as per

recommendation.

#### RESULTS AND DISCUSSION

##### *Nitrogen, chlormequat chloride and farmyard manure*

The plant height leaf-area index (LAI), bolls/plant, boll weight and seed-cotton yield were significantly increased due to FYM and nitrogen treatments. Spraying 50 ppm chlormequat chloride gave significantly more bolls/plant, boll weight and seed-cotton yield due to delayed senescence, thus helps in increasing photosynthesis and mobilization of photosynthate to reproductive sink (Dong and Artica, 1982) which in turn increase boll size and seed-cotton yield. Plant height and LAI were influenced significantly by FYM. Application of FYM @ 10 tonnes/ha increased the plant height and dry-matter accumulation. While LAI increased up to 90 days growth stage and decreased onwards due to senescence of leaf. Immaliev *et al.* (1988) reported beneficial effect of FYM on increasing leaf area and dry-matter production in cotton. An application of 100 kg N/ha significantly increased the plant height, LAI and dry-matter accumulation compared with 50 kg N/ha. With foliar spray of chlormequat chloride @ 50 and 100 ppm, plant height, LAI and dry-matter accumulation reduced significantly from the control, as it has growth retarding effect (Pipolo *et al.*, 1993). Application of 50 and 100 kg N/ha increased accumulation of 7.5, 14.9, 8.3 and 16.3 q more total the dry matter over no nitrogen during 1994 and 1995 respectively. While chlormequat chloride @ 100 ppm reduced dry matter by 9.1 and

**Table 1.** Plant height, leaf-area index, bolls/plant and boll weight of cotton as influenced by fertilizer and chlormequat chloride

Treatment	Plant height (cm)		LAI at 120 DAS		Bolls/plant		Boll weight (g)	
	1994	1995	1994	1995	1994	1995	1994	1995
<i>FYM (tonnes/ha)</i>								
0	90.8	82.8	2.45	2.47	20.0	20.5	4.47	4.79
10	95.6	97.9	2.72	2.74	22.4	22.7	4.54	4.97
CD (P = 0.05)	3.57	NS	0.11	0.11	1.6	0.61	NS	NS
<i>Nitrogen (kg/ha)</i>								
0	87.8	89.7	2.35	2.41	19.2	18.8	4.23	4.79
50	94.2	96.7	2.60	2.66	22.1	22.2	4.67	4.96
100	97.6	99.6	2.81	2.75	22.4	23.9	4.62	5.04
CD (P = 0.05)	1.60	3.82	0.10	0.14	1.42	1.37	0.19	0.24
<i>Chlormequat chloride (ppm)</i>								
0	105.0	106.4	3.05	2.90	20.3	20.3	4.33	4.65
50	88.7	91.7	2.27	2.33	21.9	21.8	4.72	5.11
100	86.0	88.0	2.27	2.29	21.5	21.7	4.67	5.02
CD (P = 0.05)	1.60	3.82	0.10	0.14	1.42	1.37	0.19	0.24

LAI, Leaf-area index; DAS, days after sowing

**Table 2.** Effect of N, chlormequat chloride and FYM on seed-cotton yield, seed and lint index, ginning (%), dry matter and N uptake of cotton

Treatment	Seed-cotton yield (q/ha)		Seed index (g)		Lint index		Ginning (%)		Dry matter (q/ha)		N uptake (kg/ha)	
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
<i>FYM (tonnes/ha)</i>												
0	23.0	24.7	9.69	9.86	5.2	5.3	34.84	34.788	53.9	62.8	89.82	104.31
10	24.1	27.7	10.0	10.12	5.3	5.4	34.80	34.82	58.9	65.4	99.58	117.28
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	11.31
<i>Nitrogen (kg/ha)</i>												
0	21.4	24.0	9.66	9.84	5.2	5.3	34.84	34.86	48.8	55.9	80.70	95.16
50	23.7	26.7	9.82	9.92	5.3	5.3	34.82	34.84	56.3	64.2	98.27	112.71
100	25.4	27.8	10.06	10.20	5.4	5.4	34.81	34.76	63.7	72.2	108.12	124.51
CD (P = 0.05)	1.17	1.59	0.16	0.15	0.11	0.08	NS	0.09	3.24	5.20	4.14	6.95
<i>Chlormequat chloride (ppm)</i>												
0	22.7	24.9	9.47	9.72	5.1	5.2	35.04	35.04	60.9	66.5	91.40	103.93
50	24.2	27.0	9.94	10.08	5.3	5.4	34.75	34.85	56.0	62.5	97.88	114.85
100	23.6	26.7	10.13	10.16	5.4	5.4	34.68	34.77	51.8	58.3	94.81	113.60
CD (P = 0.05)	1.17	1.59	0.16	0.15	0.11	0.08	0.20	0.09	3.24	5.20	4.14	6.95

**Table 3.** Grain and straw yields and N uptake of wheat as affected by residual effect of treatments

Treatment	Grain yield (q/ha)		Straw yield (q/ha)		Total N uptake (kg/ha)	
	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96
<i>FYM (tonnes/ha)</i>						
0	27.92	29.10	39.37	40.83	58.25	64.62
10	30.40	32.48	45.47	48.16	66.39	72.19
CD (P = 0.05)	NS	2.00	5.64	6.58	5.70	NS
<i>Nitrogen (kg/ha)</i>						
0	28.10	29.76	41.00	41.87	59.13	64.96
50	28.56	30.06	41.51	42.00	59.20	66.30
100	29.09	30.70	42.10	42.75	61.54	67.90
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
<i>Chlormequat chloride (ppm)</i>						
0	28.47	30.37	41.76	41.60	60.98	66.22
50	28.69	30.75	41.93	40.80	61.28	66.15
100	29.28	31.25	41.81	41.00	61.28	66.02
CD (P = 0.05)	NS	NS	NS	NS	NS	NS

8.2 q/ha compared with the control.

#### **Nitrogen uptake by cotton**

The highest N uptake in cotton was recorded with 100 kg N/ha. The increase in total N uptake over the control was 12.97 kg/ha due to absorption and assimilation of N was more by cotton (Malik and Mishra, 1984). The spray of chlormequat chloride @ 50 ppm increased N uptake significantly compared with the control. The increase was 6.48 kg/ha in 1994, while in 1995 it was 10.92 kg/ha because of N content in shoots increased with the rate of chlormequat chloride (Dabre *et al.*, 1991).

#### **Residual effect**

In 1995-96 application of FYM @ 10 tonnes/ha gave significantly higher yield than no FYM. The FYM left the highest amounts of total nitrogen in soil at harvest

of cotton and showed the highest residual effect on succeeding wheat crop. The increase of grain yield due to residual effect on succeeding wheat crop was 2.5 and 3.4 q/ha in 1994-95 and 1995-96 respectively. Straw yield increased significantly over the control being 15.5 and 18.0% higher in 1994-95 and 1995-96 respectively.

#### **Total N uptake by wheat**

The residual effect of FYM @ 10 tonnes/ha resulted in an increase of total N uptake significantly compared with the control by 12.84 and 7.57 kg/ha in 1994-95 and 1995-96 respectively because FYM partly utilized by cotton and partly left-over in soil for succeeding wheat crop.

#### **Net return**

Total net returns of cotton-wheat system when pooled together indicated that FYM

@ 10 tonnes/ha registered the highest net returns, followed by 100 kg N/ha and chlormequat chloride @ 50 pp.

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