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# EFFICACY OF NITRIFICATION INHIBITING AGENTS USED FOR AUGMENTING COTTON YIELD IN THE VERTISOL OF MADHYA PRADESH

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Field experiments conducted to study the effect of nitrification inhibiting agents revealed that blending urea either with *neem* cake or lac enhanced the seed cotton yields considerably but its efficacy seem to be more pronounced under rainfed than in semi arid-irrigated conditions. Deleterious effect of excessive nitrogen rates in vertisol of Madhya Pradesh could not be subduced even by blanding urea, particularly in rain grown upland cotton. Of the two materials employed for inflicting nitrogen economy in the black cotton soils, *Neem* coated urea was found more promising than lac coated.

Heavy losses of applied nitrogenous fertilizers, used particularly in *kharif* crops have been recorderd under Indian conditions. Amide form of N carriers, particularly urea is lost to the extent of 80% to 88% through leaching (Sharma & Ghosh, 1976), volatilization and denitrification (Basdeo and Gangwar, 1976) under various soil and climatic conditions. During recent past, inhibiting such lossess from the root zone, occurring either in the form of $NO_3$-N; $NH_4$-N or Org-N is catching attention of scientists for more efficient utilization of fertilizers. Besides various chemicals used either mixed with ammonical fertilizers (Chakravorti 1979) or applied as coating to fertilizer granules (Reddy and Prasad, 1975); blending with neem cake (Sehrawat & Parmar, 1975; Shankar *et al.*, 1976), *Karanj* cake (Ahmed *et al.*, 1978) or lac culture (Prasad, 1974) are found cheaper and effective. Most of the work, however, remained confined to the wet land crop like paddy on this aspect. Due to paucity of research reports on enhancing the N efficiency f fertilizers, field studies were carried out in black cottod soil, particularly in upland cotton, through the use of blended urea with organic materials like *neem* cake and lac culture.

## MATERIAL AND METHODS

In the field experiments run at J. N. Krishi Vidyalaya Research Stations in upland cotton nitrification inhibiting organic agents were tested under two diverse field conditions existing at Indore and Badnawar viz. rainfed and semi-irrigated respectively during 1978-79 and 1979-80. Treatments comprised two levels of nitrogen (40 and 80 kg N/ha), two methods of urea application (full at planting, ½ at sowing + ½ at square stage) and three methods of blending (NC-non coated CN-*neem* coated, CL-lac coated) urea alongwith the control (no nitrogen); making in all 14 treatment combinations, arranged in randomised black design with four replications. The method of blending urea adopted was in accordance to Anon. (1978). Besides nitrogen, a uniform dose of 40 kg

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$P_2O_5$/ha and 24 kg $K_2O$/ha in the form of super phosphate and muriate of potash respectively was applied as basal dressing to all the treatments. Varieties Khandwa 2 at Indore and Badnawar 2 at Badnawar were sown in the last week of June in both the years. Two different field conditions acquired for experimentation where rainfed at Indore and two protective irrigation (general practice of the ragion under semi-irrigated conditions (given in October and November at Bandawar. The soils of the experimental area at Indore were medium and relatively shallow while that of Badnawar were heavy and deep black cotton type making them different in physical composition. The chemical composition of the soil in respect of E. C. (mmhos), O.C. (%) and available N, $P_2O_5$, $K_2O$ (kg/ha) showed 0.18, 0.398 and 197, 31, 580 values for Indore and 0.22, 0.518 and 241, 30, 750 for Badnawar respectively. A deficit rainfall was recorded at both the locations during the years of field study (Figure 1.)

## RESULTS AND DISSCUSIONS

Blending urea with two different nitrification inhibiting substances influenced the *kapas* production substantially both in rainfed (Indore 1978-79) and semi arid-irrigated (Badnawar 1979-80) Conditions. Data presented in Table 1 reveal a sigificant difference in yield, boll number/plant and yield/plant in both the years due to different treatments. Maximum yield of 382 kg/ha under rainfed in shollow soils of Indore in 1978-79 and that 828 kg/ha in semi arid irrigated, deep soil conditions of Badnawar in 1979-80 were recorded in *neem* coated urea applied at 80 kg N/ha in two equal splits. Even though blending urea with *neem* cake pushed up the seed cotton yield much higher to non-coated, the increase remained invariable marginal over the lac coating treatments. At lower rates (40 kg/ha) the mean yield due to split applicatin of uncoated urea remained unaltered when compored with solitary application but it showed a rise of 13% and 15% in case of *neem* and lac coating respectively. No such trend was evidenced at higher nutrient levels, However, yield declined considerably (2.6%) at Indore at 80 kg N/ha, applied all at planting (table 1 & 2). Relatively lower boll number/plant and yield/plant as observed in this treatment lead to the inference that excessive nitrogen at planting under rainfed conditions caused deleterious effect on fruiting phase and the effects could not be subdued even by blending urea with nutrification inhibiting agents. Such adverse effects on growth and yield, however, disappeared with split application of nitrogen, particularly in Semi-arid irrigated conditions.

The studies brought out clearly that despite slightly reduced advantages of blending urea at higher nitrogen rates (80 kg N/ha) under rainfed condition, the seed cotton yields could be enhanced adequately at recommended dose from 19% to 32% under unirrigated conditions and from 4% to 7% under semi arid irrigated conditions (Table 3). Coating urea with *neem* cake appear to be more pormising than the lac coated, irrespective

of the nutrient levels of the field conditions, acquired for growing upland cotton in the vertisol of Madhya Pradesh.

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Table 1 : Effect of blended urea on the yield and ancillary characters of cotton

| Treatments | Yield (kg/ha) | | | Boll/plant (No.) | | Yield/plant (g) | | Plant height (cm | |
|---|---|---|---|---|---|---|---|---|---|
| | 1978-79 | 1979-80 | Mean | 1978-79 | 1979-80 | 1978-79 | 1979-80 | 1978-79 | 1979-80 |
| a) *All at planting* (kg/ha) | | | | | | | | | |
| Urea (NC)@ 40 N | 267 | 602 | 436 | 3.4 | 6 8 | 7.7 | 20.5 | 63 | 91 |
| Urea (CN)@ 40 N | 331 | 639 | 485 | 4.5 | 6.7 | 12.4 | 23 7 | 69 | 93 |
| Urea (CL)@ 40 N | 324 | 616 | 470 | 3.3 | 7.6 | 7 9 | 19.5 | 60 | 87 |
| Urea NC)@ 80 N | 214 | 699 | 457 | 2 5 | 8.1 | 6.0 | 28.2 | 59 | 96 |
| Urea (NC)@ 80 N | 259 | 754 | 507 | 2.4 | 8.3 | 6.0 | 28.0 | 66 | 99 |
| Urea (CL)@ 80 N | 258 | 708 | 483 | 2 3 | 7.6 | 6.5 | 24.8 | 64 | 95 |
| Control | 207 | 454 | 331 | 2 4 | 5.1 | 5.0 | 16 1 | 49 | 77 |
| b) ½ at planting + ½ square stage (kg/ha). | | | | | | | | | |
| Urea (NC)@ 40 N | 253 | 616 | 435 | 2 8 | 6.3 | 8.4 | 19.4 | 67 | 82 |
| Urea (CN)@ 40 N | 361 | 736 | 549 | 4 2 | 8.7 | 10.4 | 28,9 | 67 | 87 |
| Urea (CL)@ 40 N | 360 | 718 | 539 | 3.7 | 5.9 | 9.6 | 21.5 | 62 | 86 |
| Urea (NC)@ 80 N | 273 | 770 | 523 | 3.4 | 7.2 | 8 6 | 23·2 | 71 | 90 |
| Urea (CN)@ 80 N | 382 | 828 | 605 | 3.7 | 9 3 | 9.0 | 29.6 | 63 | 91 |
| Urea (CL)@ 80 N | 324 | 819 | 572 | 3 7 | 7,9 | 8,2 | 25,6 | 70 | 93 |
| Control. | 227 | 495 | 361 | 2.8 | 4,9 | 6.7 | 15 7 | 52 | 83 |
| C. D at 4.5% | 97.0 | 57.4 | — | 1.32 | 1.96 | 3.15 | 8 31 | NS | NS |

NC—Non coated :
CN—Neem coated
CL—Lac coated
N. S.—Non-significant.

Table 2 : Yield response (kg/ha) under different nutrient levels and field conditions.

| N levels | Rainfed | | Mean | Semi-irrigated | | Mean |
|---|---|---|---|---|---|---|
| | Full | 1/2+1/2 | | Full | 1/2+1/2 | |
| 40 kg N/ha | 307 | 325 | 316 | 620 | 690 | 655 |
| 80 kg N/ha | 244 | 285 | 285 | 720 | 806 | 763 |
| Mean | 276 | 301 | 301 | 670 | 748 | 769 |

Table 3 : Effect of coating urea applied at two nutrient levels

(Seed cotton yield kg/ha)

| Treatments | Urea 40 kg N/ha | | Mean | Urea 80 kg/N ha | | Mean |
|---|---|---|---|---|---|---|
| | 1978-8 | 1979-80 | | 1978-79 | 1979-80 | |
| NC | 260 | 609 | 435 | 244 | 735 | 490 |
| CN | 346 | 688 | 517 | 321 | 791 | 555 |
| | (33) | (13) | (19) | (32) | (7) | (14) |
| CL | 342 | 667 | 504 | 291 | 763 | 527 |
| | (32) | (10) | (16) | (19) | (4) | (7) |
| Mean | 316 | 655 | 485 | 285 | 763 | 524 |

Figures in the parenthesis denote the % increase over NC treatment.