

Integrated nutrient management in rainfed hybrid cotton

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Abstract : A field experiment was conducted at Regional Research Station, Bhawanipatna, Kalahandi, Orissa in the *Kharif* seasons of 1997 and 1998. The treatment N, P and K @ 100, 50 and 50 kg ha⁻¹ along with Azatobacter and Phosphorus Solubilizing Micro-organisma @ 5 kg ha⁻¹ each, ZnSO₄ 25 kg ha⁻¹ and FYM @ 10 t ha⁻¹ produced the highest seed cotton yield of 2728 kg ha⁻¹ and that was on par (2695 kg ha⁻¹) with the above treatment minus ZnSO₄ 25 kg ha⁻¹. The crop height, bolls / plant and the boll weight recorded for both the above treatments were also on par with each other for both the years. However, the net return per rupee invested was the highest (Rs. 2.43) for the treatment N, P and K @ 100, 50 and 50 kg ha along with Azatobacter and Phosphorus Soubilizing Micro-organisms @ 5 kg ha⁻¹ each and FYM @ 10 t ha⁻¹ followed by Rs. 2.26 for the treatment N, P and K @ 100, 50 and 50 kg ha⁻¹ along with Azatobacter and Phosphorus Solubilizing Micro-organisms @ 5 kg/ha⁻¹ each, ZnSO₄ 25 kg ha⁻¹ and FYM @ 10 t ha⁻¹. (**Key words :** INM, Hybrid Cotton, Rainfed).

Cotton (*Gossypium sp.*) is a highly remunerative crop and also tolerates drought to a considerable extent. These are the major reasons that cotton acreage is continuously increasing in the drought-prone district of Kalahandi, Orissa. However, the yield level of cotton is very low in Kalahandi. Hence, it is essential to recommend optimum and balanced dose of N, P and K for sustained yield, as is done in Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu (Tandon, 1995). Application of Azatobacter and Phosphobacteria are reported to produce growth promoting substances, antifungal antibiotics and proliferate beneficial organisms in rhizosphere which in turn facilitate an uniform germination, improve seedling vigour and result in healthy plant stand leading to higher yields. It is also reported that application of zinc to cotton crop promotes boll retention and seed cotton yield (Prasad and Prasad, 1998). Keeping this in view, the present experiment was designed to find out an integrated nutrient schedule for increasing yield and net return from rainfed hybrid cotton crop for Kalahandi district of Orissa.

Materials and Methods

A field experiment was conducted at Regional Research Station, Bhawanipatna in the rainy seasons of 1997 and 1998. The experiment was laid out in randomised block design with three replications. The treatments comprised of N, P and K @ 100, 50 and 50 kg ha⁻¹ (T₁), 120, 60 and 60 kg ha⁻¹ (T₂), 140, 70 and 70 kg ha⁻¹ (T₃), T₁ + FYM @ 10 t ha⁻¹ (T₄), T₁ + ZnSO₄ @ 25 kg ha⁻¹ (T₅), T₁ + FYM + ZnSO₄ (T₆), T₁ + FYM + Phosphobacteria (PSM) 5 kg ha⁻¹ (T₈), T₁ + FYM + Azatobacter + PSM (T₉) and T₁ + FYM + Azatobacter and PSM + ZnSO₄ (T₁₀). All the phosphatic fertilizer, FYM, ZnSO₄, Azatobacter and PSM were applied basally at the time of final land preparation. The potashic fertilizer was applied in

two splits, i.e., 50 percent basally and 50 percent at 60 days after sowing. The nitrogeous fertilizer was applied in three equal splits, i.e., one part each basally, 30 days and 60 days after sowing. The cotton hybrid "Savitha" was sown by dibbling method at a spacing of 90 cm x 90 cm on 16th and 14th June in respective years. Thinning was done to maintain one plant per hill. The plant protection measures were taken as per recommendation. The soil of the experimental field was loamy clay in texture with pH 7.2, low in organic carbon (0.48%), low in available P (8.2 kg ha⁻¹) and moderately high in available K (282.0 kg ha⁻¹). The precipitation received in two cropping seasons were 933 mm and 901 mm respectively.

Results and Discussion

Application of N, P and K @ 100, 50 and 50 kg ha⁻¹ in conjunction with Azatobacter and PSM @ 5 kg ha⁻¹ each and FYM @ 10 t ha⁻¹ (T₉) had exhibited the highest crop height of 137.4 cm (mean of two years) and was on par with application of the above with ZnSO₄ @ 25 kg ha⁻¹ (T₁₀) (137.2 cm). In the year 1997 application of T₁ + FYM @ 10 t ha⁻¹ + PSM @ 5 kg ha⁻¹ (T₈) was stastically on par with T₉ and T₁₀ as regards to crop height (Table 1). The highest number of bolls per plant was produced by the treatment T₁₀ in both the years and was statistically on par with that of T₉ and T₆. Higher number of boll retention per plant with application of zinc was also reported by Prasad and Prasad (1998). The highest boll weight (5.16 g) was recorded in case of T₉ and was on par i.e. 5.15 g with T₁₀ (mean of two years). Production of higher yield attributes were also reported due to application of Azatobacter in conjunction with balanced N, P and K and FYM by Shende *et al.* (1977). Similar results were produced due to application of PSM in place of Azatobacter and was in confirmity with Guar (1990) and Sattar and

Table 1. Yield attributes, yield and economics of hybrid cotton as influenced by Integrated Nutrient Management

Treatment	Crop height (cm)		Bolls / plant (g)		Boll weight		Seed cotton yield (kg/ha)			Benefit : Cost Ratio	
	1997	1998	1997	1998	1997	1998	1997	1998	Mean	Mean	Mean
T ₁ = N:P ₂ O ₅ : K ₂ O : 100:50:50 kg/ha ⁻¹	115.8	121.6	37.3	39.2	4.22	4.29	1742	1896	1819	1.62	1.62
T ₂ = N:P ₂ O ₅ : K ₂ O : 120:60:60 kg/ha ⁻¹	122.3	128.2	40.4	43.8	4.46	4.82	1852	1982	1917	1.68	1.68
T ₃ = N:P ₂ O ₅ : K ₂ O : 140:70:70 kg/ha ⁻¹	126.7	130.4	42.2	44.4	4.66	4.74	1985	2016	2001	1.66	1.66
T ₄ = T ₁ + FYM @10t/ha ⁻¹	124.2	128.2	42.4	40.8	4.56	4.62	2126	2212	2169	1.90	1.90
T ₅ = T ₁ + ZnSO @25kg/ha ⁻¹	120.4	120.8	40.0	40.6	4.18	4.56	1806	2026	1914	1.57	1.57
T ₆ = T ₁ + FYM + ZnSO ₄	126.8	128.6	45.8	48.5	4.27	4.36	2086	2357	2222	1.82	1.82
T ₇ = T ₁ + FYM + Azatobacter @5kg/ha ⁻¹	130.2	136.4	42.0	44.8	4.42	4.62	2270	2353	2312	1.99	1.99
T ₈ = T ₁ + FYM + PSM @5kg/ha ⁻¹	134.6	132.2	40.2	45.6	4.82	4.88	2232	2518	2375	2.07	2.07
T ₉ = T ₁ + FYM + Azatobacter + PSM	134.4	140.4	46.8	48.2	5.22	5.10	2568	2822	2695	2.43	2.43
T ₁₀ = T ₁ + FYM + Azatobacter + PSM + ZnSO ₄	133.6	140.8	47.9	50.6	5.06	5.24	2538	2917	2728	2.26	2.26
C.D.(0.05)	3.71	4.48	2.11	2.85	0.31	0.27	192.8	238.0	221.3		

Guar (1987). It is observed from Table 1 that the mean seed-cotton yield was the highest for the treatment T10 (2728 kg ha⁻¹) and was on par with that of T9 (2695 kg ha⁻¹). Guar and Alagawadi (1988) reported that dual inoculation of Azatobacter and PSM have more pronounced effect on population of bacteria in the rhizosphere and hence produce more yield which might be due to release of higher quantities of root exudates as soluble carbohydrates and sugars into rhizosphere. Vyas and Vyas (1994) reported that biofertilisers like Azatobacter found in the rhizosphere are capable of fixing upto 40 kg N/ha⁻¹ year assymbiotically from the atmosphere and PSM have enormous potential to solubilise about 50-60 percent of fixed P in soil by secreting organic acids within a short period. In the present study these might have resulted in much higher seed cotton yield due to application of Azatobacter and PSM in conjunction with moderate fertilizers rather than application of only higher fertilizer doses.

The net return per rupee invested was recorded to be the highest (Rs. 2.43) for treatment T9 and closely followed by T₁₀ (Rs. 2.26) and T₈ (Rs. 2.07). This can be inferred from the present study that application of N, P and K at the rate of 100, 50 and 50 kg ha⁻¹ along with Azatobacter and PSM @ 5 kg ha⁻¹ each and FYM @ 10 t ha⁻¹ is the economic optimum dose of integrated nutrient required for rainfed hybrid cotton grown in Kalahandi District.

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