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Impact of Package of Practices on the Production Potential and Economic Returns of Upland Cotton Under Nimar Conditions*

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Field studies over three years conducted to determine the impact of package of practices on the production potential and economic returns of upland cotton under Nimar conditions of Madhya Pradesh indicated that under low input technology fertilizer and planting pattern form an integral part of rainfed cultivation. Among the two inputs, the fertilizer and plant protection, the former appeared to be an unavoidable and more economic constraint to boost up the seed cotton yields. Improved package of practices had always an edge over the conventional practices, irrespective of the varieties grown. Re-arranging cotton plantation in skip or paired row alongwith other inputs accelerated the cost-benefit ratio from 55 p. to Rs. 1.07 or Rs. 1.21 respectively for every rupee spent. Ridging and furrowing at each interculture and tyeing of ridges at 60 — 70 days provided extra monetary returns.

In cotton tracts where untapped yield reservoir exists at current level of technology, apparently, the fertilizer and plant protection form important technological constraints, besides vulnerable varieties. Despite the evolution of number of hybrid varieties (Patel, 1971; Katarki, 1971; Bahavandoss *et al.*, 1973; Julka *et al.*, 1977) during eighties, much headway could not be made to boost-up country's production of cotton. Reviewing the statistical data for past decade or so, it would be clear that the yields have remained more or less static.

New avenues have, however, opened since the breeding strategies like diallel cross analysis (White, 1964; Patel, 1971) heterosis (Joshi *et al.*, 1960; Singh *et al.*, 1978); Line x tester analysis (Singh *et al.*, 1971; Julka *et al.*, 1979) and Male sterile line (Santhanam *et al.*, 1972; Srinivasan and Gururajan, 1974) are employed either to improve the genetic architecture or to explore the potent combiners. Even then factors like diverse geographic origin, genetic diversity and magnitude of heterosis jeopardize their economic feasibility on the commercial scale. Since it is difficult to get a crop ideo-type (Swaminathan, 1979) to suit different micro and macroclimatic zones; efforts have to be directed to develop econo-

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mically viable technology. Recently Brar and Singh (1978), Jain and Jain (1979) have suggested new agro-techniques for higher cotton yields. Massive use of such technology to suit the rainfed conditions is imperative for the up-rise of production curve in cotton. Eventually, the success of such venture will depend on the low input agro-techniques. With this theme in mind a field study on various improved package of practices was undertaken in the Nimar tract of Madhya Pradesh.

MATERIAL AND METHODS

Adoptive trials were carried out for a period of three years from 1978-79 to 1980-81 under A. I. C. C. I. Project at the Cotton Research Station JNKVV, Campus Khandwa. The soil of the experimental area were medium black with low fertility having following mechanical and chemical composition.

Seven treatments comprising local practice (LP) of this tract, local practice (drilling) + recommended fertilizers (LF); local practice + recommended fertilizers and plant protection measures (LFP); improved practices (square planting) + recommended fertilizers and plant protection (IFP); paired row + recommended fertilizers and plant protection (PFP); skip row + recommended fertilizers and plant protection (SEP); paired row + recommended fertilizers and plant protection with ridging and furrowing at each interculture and tyeing of ridges after 60 to 70 days of sowing (PEPT). The impact of such agro-techniques was assessed on two of upland cotton viz., Khandwa-2 being local and KH 33/1146 an improved one, making in all 14 treatments combinations in a plot size of 40.0 m $\times$ 5.4 m dimension. The recommended fertilizer dose was 60 N + 40 P_2O_5 + 20 K_2O kg/ha, of which N was applied as urea in two equal splits while P_2O_5 and K_2O were given in full dose as basal in the form of super phosphate and muriate of potash respectively The recommended plant protection schedule comprised of three sprays of suitable insecticides for sucking pests and boll worm, distributed at different stages of crop. Sowing of the crop was done in the last week of June every year.

Rainfall distribution was erratic but moderate (855 mm) in 1978-79 while that in the subsequent years (1161 mm and 927 mm) it exceeded the average (851 mm) precipitation. Three years seed cotton yield data was pooled and put to statistical analysis.

RESULTS AND DISCUSSION

A perusal of data presented in Table I reveals that local starin Khandwa 2 invariably prevailed upon variety KH 33/1146 in the three years of field study. Over all yields of two genomes due to different package of practices, however, registered a non-significant different. It would be seen from the data that mean yields noted over the years showed a conspicuous difference, lowest average being in the year 1978-79. This may be due to seasonal differences. Adepquate rains received during the growth phase, supplemented by winter rains during boll formation, perhaps resulted in higher seed cotton yields both in 1979-80 and 1980 81.

It is further noted that the response to various inputs included in the agro-techniques, differed significantly, though the interaction (VXT) remained non-significant. Improved practices always had an edge over the conventional practices. Mean yields over three years indicate that both Khandwa 2 as well as KH 33/1146 responded remarkably to the recommended dose of fertilizer (60 N + 40 P + 20K kg/ha) applications and plant protection measures, though the former caused greater magnitude of rise in cotton yields than the latter constraint. A distinct increase in raw cotton yield due to fertilizers was noted even in the local practices (LP) where sowing was done by drilling. These observations are in confirmity to the findings of Mukerji *et al*. (1976), who reported 18% to 29% increase due to fertilizer application. These observations lead to the inference that of the two constraints fertilizer is unavoidable for the marginal cultivation and may be prefered over the plant protection measures under low input technology.

Data in Table II clearly brought out that Khandwa 2 responed relatively better to different management practices, though non-monetary inputs like planting methods exhibited slightly different trend in either cultivars. Variety KH 33/1146 showed a greater stride in yield when sown in paired row pattern while Khandwa 2 performed better under solid as well as skip row systems. Compared to the traditional method of sowing i. e. drilling, both the strains produced 12, 20 and 28 per cent higher mean yields in square (Chaufuli), paired and skip row pattern of planting respectively. These observations are in consonance with the report of Jain and Jain (1979). Yield level reached to its peak, registering an increase of 500 kg/ha in Khandwa 2 and 538 kg/ha in KH 33/1146 when paired row was adopted and ridging at each interculture was followed by tyeing of ridges after 60-70 days. These observations are in line with the findings of Selveraj *et al*. (1974), who reported distinct advantages of such agro-technique under rainfed conditions. Present field studies give a clue that the package of practices have high potentiality in boosting-up the *kapas* yields to the extent of even 82% (Table II) in Nimar region of Madhya Pradesh. Simply by bringing about a slight modification in planting technology from drilling to paired or skip row systems, a hike of 20% to 28% in yield may be obtained.

Cost benefit ratio : As indicated in Table III, local practices of cotton cultivation gave the lowest cost-benefit ratio (1:0.55). Contrary to this gain of only 55 paisa for every rupee spent, application of fertilizer and plant protection triggered it to 95 paise which further got accelerated to Rs. 1.21 when planting was switched over from drilling to skip row system. Mukerji *et al.* (1976) also reported increased money return values due to inclusion of improved cultivation practices. By adopting simple field technology of ridging at each interculture and tyeing of ridges at 60 to 70 days, the net profit went higher by Rs. 286/- per hectare and cost benefit ratio rose from 1.07 to 1:1 19. This may be attributed to favourable soil microbial and environmental conditions created by mechanical operation. Better moisture conservation resulting by tyeing of ridges and furrows (Selveraj *et al.*, 1974) might have contributed to the economic yields and higher monetary returns.

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A. Mechanical Composition of Soil.

Years	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	$CaCO_3$ (%)	Exch. Na (%)
1978—79	0—30	12.88	33.28	53.85	3.40	2.16
	30—60	10.88	34.56	54.56	3.50	0.56
1979—80	0—30	10.88	30.28	58.56	3.10	2.00
	30—60	8.88	31.56	59.56	3.30	0.90
1980—81	0—30	21.88	49.28	29.89	6.10	2.16
	30—60	62.88	29.89	7.84	15.30	2.16

B. Chemical Constituents of Soil.

Years	Depth (cm)	pH	E. C. (mmhos)	O. C. (%)	Available kg/ha N	P_2O_5	K
1978-79	0–30	8.2	0.40	0.360	258	32	780
	30–60	8.2	0.20	0.276	231	33	5[illegible]0
1979-80	0–30	7.7	0.50	0.413	297	21	400
	30–60	7.8	0.40	0.387	256	26	570
1980-81	0–30	7.2	0.60	0.3[illegible]0	274	56	500
	30–60	7.2	0.50	0.240	299	66	300

TABLE 1: Yield response (kg/ha) to package of practices of Kw 2 and KH 33/1146.

Treatments	1978-79 Kw 2	KH 33	1979–80 Kw 2	KH 33	1980-8 Kw 2	KH 33	Mean Kw 2	KH 33
LP	170	115	610	627	328	296	369	346
LF	304	239	915	905	534	476	584	540
LFP	366	397	1005	915	646	571	672	628
IFP	425	448	1165	991	721	625	770	638
PFP	414	444	1112	1243	756	708	760	793
SFP	432	460	1265	1163	870	781	856	811
PFPT	456	490	1294	1352	856	809	869	884
Mean	376	370	1052	1028	673	609	697	669

Significance for treatments : SE $\pm$ 29.34 CD at 5% 85.05

Significance for varieties : SE $\pm$ 15.68 CD at 5% NS

Significane for years : SE $\pm$ 19.21 CD at 5% 55.68

Significance for interaction : SE $\pm$ 41.49 CD at 5% N.S.

TABLE : II Mean increase in yield due to various management practices.

Management practices	Varieties		Mean increase (%)
	Kw 2	KH 33	
a. Fertilizer response (LF—LP)	215	194	57
b. Plant Protection (LFP - LF)	88	88	16
c. Plant. Prot. + Fer. (LFP—LF)	303	282	82
d. Square planting (IFP—LFP)	98	60	12
e. Paired row pltg. (PFP—LFP)	88	170	20
f. Skip row pltg. (SFP—LFP)	184	173	28
g. Ridging tying (PFPT—LFP)	197	256	35

TABLE III Cost benifit ratio for various management constraints.

Treatments	Mean yield (kg/ha)	Gross income (Rs.)*	Expenditure (Rs.)**	Net profit (Rs.)	Cost benefit ratio
LP	358	1163	750	413	1:0.55
LF	562	2248	1230	1018	1:0.82
LFP	650	2520	1380	1240	1:0.89
IFP	729	2916	1500	1416	1:0.95
PFP	779	3116	1500	1616	1:1.07
SFP	829	3316	1500	1816	1:1.21
AFPT	877	3308	1600	1908	1:1.19

* Income was based on the mean yield and calculated at Rs. 400/- per quintal of kapas for all the treatments except LP where it was at Rs. 325 00/q due to inferior quality lint.

** Expenditure was calculated on the basis of various inputs used to formulate a particular treatment.