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Impact of Transplanting Period on Pest Incidence and Yield of Rice in Middle Gujarat

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ABSTRACT

Field experiments carried-out during three successive *kharif* seasons (1995-96 to 1997-98) at the Main Rice Research Station, Gujarat Agricultural University, Nawagam (Gujarat) revealed that the incidence of leaf folder, *Cnaphalocrocis medinalis* Guen., stem borer, *Scirpophaga incertulas* (Walker) and white backed plant hopper, *Sogatella furcifera* (Horvth) was low in rice crop transplanted during the period of third week of June and first week of July. Damage of these pests increased as the transplanting period delayed. Maximum grain (4470 kg/ha) and fodder (6445 kg/ha) yields was harvested by transplanting the crop early (third week of June) and decreased in subsequent transplanting period (first and third week of July and first week of August). Highest (Rs. 30043 ha) economic return was earned by transplanting the crop early (third week of June). The trial concluded that about 50 to 55% more income could be achieved, if the rice crop is transplanted during the period of late June and early July.

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INTRODUCTION

Rice, the important cereal crop of Gujarat is attacked by various pests and causes considerable yield losses. Farmers mostly depend on broad-spectrum insecticides to manage the pests. Realizing danger of synthetic toxic insecticides, the use of non-chemical measures gaining importance in IPM strategy. Manipulation of transplanting period is non-monetary input and feasible alternative to counter the problem of pest resistance to insecticides. According to Thompson *et al.* (1994), planting date is a potential cultural method in rice crop and has greater impact on yield than does carbofuran treatment.

Sufficient work on influence of transplanting period of rice in relation to insect pests has been done in various rice growing states of India and reported optimum period of transplanting considering the pest incidence, yielding and agro-ecosystem of respective region. So far no such attempt has been made in Gujarat. It was therefore, felt necessary to find out the most appropriate transplanting-period of rice to avoid the excess pest pressure and to harvest maximum yields. With this in view, the present study was undertaken and the results obtained are presented here under.

MATERIALS AND METHODS

A field experiment was carried out for three successive *kharif* seasons (1995-96 to 1997-98) at the Main Rice Research Station, Gujarat Agricultural University, Nawagam (Gujarat). The trial was laid-out in Randomized Block Design with four treatments replicated six times. The four treatments comprised transplanting period of rice crop planted at fortnightly interval from the begining of third week of June to first week of August. The gross and net plot size was 6.9 x 4.0 m. and 5.7 x 2.8 m. respectively. Susceptible cultivar (GR-11) of rice was used for the study. Transplanting of seedling was done as per the treatment at 20 x 15 cm. spacing. The crop was fertilized with 100 kg N and 25 kg P_2O_5 per ha. All other normal recommended agronomic practices, except plant protection were followed for raising the good crop. Observations on pest incidence were recorded during its peak activity period. Incidence of leaf folder, *Cnaphalocrocis medinalis* Guen was assessed by counting total and leaf folder damaged leaves on 10 hills selected randomly from net plot area. Similarly, white backed plant hopper, *Sogatella furcifera* (Horvth) population appeared during 1996 *kharif* season only, assessed by counting total number of hoppers on 10 hills from net plot area. The stem borer, *Scirpophaga incertulas* (Walker) damage was noticed very late i.e. at heading stage and it was assessed by counting total number of white earheads per plot. At harvest, grain and fodder yield was weighed separately from net plot area of each treatment. Economics of each of the treatments was worked out on the basis of return from grain and fodder yields.

RESULTS AND DISCUSSION

Results (Table 1) indicated that transplanting period and significant impact on lead folder incidence assessed during three years of experimentation. Damage of the pest was significantly low (0.46 to 0.52%) in crop transplanted early (3rd week of June) than that of late (1st week of August) transplanted ones. The crops transplanted during late July and early August suffered heavily by leaf folder damage. Though the pooled data failed to show significant effects of transplanting period, relatively low (0.49%) incidence of leaf folder was recorded in first crop and increased in subsequent crops. Kushwaha and Sharma (1983)) from Haryana, India and Wei (1990) from China reported that greater attack of *C. medinalis* was found in late transplanted crop than early transplanted. These reports corroborated with the above results. Further, Gangawar and Ahamedi (1990) found that the rice crop planted in June or first week of July reduced the losses due insect pests and diseases than the crop planted in August. This is in close agreement to the present findings. However, in contrast to above reports, Saroja and Raju (1983) recorded heavy damage of leaf folder in early crop (planted between 5 August and 5 September than late) crop (planted between 20 September and 5 November), because of maximum tillering and early flowering coincided with peak population of the pest in Tamil Nadu. The difference in opinion may be due to variation in pest activity period and cropping pattern in a locality.

Stem borer, *S. incertulas* incidence varied significantly with the period of transplanting (Table 1). The crop transplanted until first week of July showed significantly low incidence of the pest during 1995-96 (0.50 to 0.83 WE/Plot) and 1997-98 (4.83 to 7.83 WE/ Plot). Pooled data did not revealed significant influence of the treatments, however early transplanted crops (3rd week of June and 1st week of July) registered low (2.67 to 4.33 WE/ Plot) incidence of stem borer at heading stage and damage intensity increased as transplanting period delayed. This is in confirmity with the report of Rustamani *et al.* (1995) from Pakistan, where they found that stem borers infestation in rice increased gradually with delayed transplanting dates.

TABLE 1

Effect of transplanting on leaf folder and stem borer incidence.

Sr. No.	Treatments (Transplanting period)	Mean % LF Damage				Av. No. WE/Plot		
		19995-96	1996-97	1997-98	Pooled	1995-96	1997-98	Pooled
1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Third week of June	0.52	0.48	0.46	0.49	0.50 (0.90)*	4.83 (2.28)	2.67 (1.59)
2.	First week of July	0.80	2.71	0.70	1.40	0.83 (1.09)	7.83 (2.74)	4.33 (1.91)
3.	Third week of July	0.63	4.86	3.83	3.11	5.33 (2.23)	12.33 (3.51)	8.83 (2.87)
4.	First week of August	1.39	4.93	5.74	4.02	18.17 (4.23)	15.67 (3.99)	16.92 (4.11)
S. Em. ±	Treat.	0.06	0.24	0.27	0.756	0.33	0.22	0.428
	Year	—	—	—	0.107	—	—	0.138
	T x Y	—	—	—	0.213	—	—	0.276
C.D. at 5%	Treat.	0.19	0.72	0.82	NS	0.98	0.65	NS
	Year	—	—	—	—	—	—	—
	T x Y	—	—	—	0.61	—	—	0.80
C. V. (%)		18.15	18.12	24.99	23.17	37.75	16.84	25.79

*Figures in parenthesis are $\sqrt{x + 0.5}$ transformed values.

The amount of *S. incertulas* damage recorded by Singh *et al.* (1990) to rice plants in Punjab was lower in crop transplanted on 15th June and the number of tillers (and hence the grain yield) were higher compared to the plants transplanted on 30th June and 15th July. This is in close agreement with present report.

Significantly leaf (5.53 hoppers/hill) number of white backed plant hopper, *S. furcifera* were registered in early transplanted (3rd week of June) crop than that of the crops transplanted during July and August (Table 2). Pest population was in increasing fashion as the transplanting period delayed. Maximum (10.30 hoppers/hill) population of *S. furcifera* was recorded in late (1st week of August) transplanted crop. According to Pradhan *et al.* (1983), the damage of *S. furcifera* to late planted crop was most serious than early planted ones in Nepal. Similarly, Ma kyoungchu and Lee Seungchan (1996) from Korea, the late transplanting of rice induced the higher population densities of brown plant hopper (*Nilaparvata lugens*) white backed plant hopper (*Sogatella furcifera*) and green

leaf hopper (*Nephotettix cincticeps*). These reports are akin to the present results.

Significant impact of transplanting period on grain yield was revealed during 3 years of study (Table 3). Significantly higher yield was harvested when the rice was transplanted during the period of third week of June (3509 to 6031 kg/ha) and first week of July (3112 to 5801 kg/ha) than the crop transplanted during August (2558 to 3195 kg/ha). Inspite of statistical difference noticed during three years of experimentation, pooled results revealed non-significant impact of the treatments. However, the crop planted early (3rd week of June) produced highest (4470 kg/ha) grain yield followed by the crop planted 15 days later (4318 kg/ha). Similarly, fodder yield was also recorded highest (6445 kg/ha) in former treatment and was in decreasing fashion as the transplanting period delayed. Gangwar and Sharma (1977) recorded

TABLE 2

Effect of transplanting period on hopper population appeared during *kharif* 1996.

Sr. No.	*Treatments (Trans. period)*	*Av. No. WBPH/Hill*			
		3rd week of Sept.	*1st week of Oct.*	*2nd week of Oct.*	*Mean*
1.	Third week of June	5.93	7.45	3.20	5.53 a
2.	First week of July	7.60	11.22	3.90	7.57 b
3.	Third week of July	9.45	13.13	3.12	8.57 b
4.	First week of August	11.43	16.32	3.13	10.30 c
	S. Em. ±	0.56	0.88	0.26	0.42
	C. D. at 5%	1.69	2.66	0.78	1.26
	C. V. (%)	16.04	17.99	19.08	12.86

Means followed by the same letter in a column are not statistically different.

TABLE 3

Effect of transplanting period on yields of paddy.

Sr. No.	*Treatments (Transplanting period)*	*Grain (kg/ha)*				*Fodder (kg/ha)*			
		1995-96	*1996-97*	*1997-98*	*Pooled*	*1995-96*	*1996-97*	*1997-98*	*Pooled*
1.	Third week of June	3869	3509	6031	4470	5362	5138	8835	6445
2.	First week of July	4041	3112	5801	4318	4877	4835	7487	5733
3.	Third week of July	3430	2590	5148	3723	5681	4939	6516	5712
4.	First week of August	3195	2558	2684	2813	4741	4699	5086	4842
S. Em. ±	Treat.	156.1	109.5	151.7	412.1	260.7	125.3	378.8	488.6
	Year	—	—	—	70.3	—	—	—	137.6
	T x Y	—	—	—	140.7	—	—	—	275.2
C.D. at 5%	Treat.	470.5	329.9	457.3	NS	NS	NS	1141.6	NS
	Year	—	—	—	—	—	—	—	—
	T x Y	—	—	—	402.1	—	—	—	786.4
C. V. (%)		10.52	9.11	7.56	9.00	12.36	6.26	13.29	11.86

TABLE 4

Economics of various treatments used in study.

Sr. No.	Treatments (Transplanting period)	Yield (kg/ha)		Income (Rs./ha)		Gross income (Rs./ha)	Income increase over late Planting
		Grain	Fodder	Grain	Fodder		
1.	Third week of June	4470	6445	26820	3223	30043	55.67 %
2.	First week of July	4318	5733	25908	2867	28775	49.10 %
3.	Third week of July	3723	5712	22338	2856	25194	30.55%
4.	First week of August	2813	4842	16878	2421	19299	—

Price : Grain Rs. 600/Qtl. Fodder Rs. 50/Qtl.

significantly higher grain yield (4.06 t/ha) from 1 July transplanted crop over 31 July (3.22 t/ha) and 16 August (2.54 t/ha) supported the present findings where early planted crop yielded higher.

Economics of various treatments under study (Table 4) clearly indicated that maximum (Rs. 30,043/ha) return was obtained by transplanting the crop early (3rd week of June). The amount of return decreased as the transplanting period delayed. About 50 to 55% more income earned by transplanting the crop during the period of third week of June and first week.

Thus, from the data of pest incidence, yield and profitability point of view, the study it could be concluded that tranplanting of rice crop during late June or early July found to be optimum in middle Gujarat conditions. Normally, pest incidence on rice crop in the region appears in September and October months. Meanwhile crop become sturdy, capable to tolerate the attack of pest and hence escape from the heavy damage.

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