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Effect of planting dates on the incidence of major rice pests

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ABSTRACT

Trial on effect of planting dates on pest incidence was conducted at Agriculture Research Station, Sakoli, Dist. Bhandara during kharif 2016 to kharif 2020 with an objective to study the influence of date of planting on insect pest incidence and population dynamics in paddy crops. Incidence of gall midge, stem borer, leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper was recorded in these trials. The results revealed that early planting significantly reduced the incidence of gall midge followed by normal planting and highest incidence was exhibited in late planting. No significant difference was found in incidence of stem borer in different planting. Low incidence of leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper were recorded in different plantings. The highest yield was exhibited in early planting and followed by normal planting.

Keywords: *Rice, effect of planting dates, insect pests incidence.*

INTRODUCTION

Rice (*Oryza sativa* L.) belonging to the family Gramineae is the staple food for a large part of the world's population. India has the largest area of 43.13 million ha, with the production of 104.80 MT which ranks second in production next to China and contributing 43 per cent of total food grain production and 46 percent of total cereal production and continues to play a vital role in the national food grain supply (Anonymous, 2020a). In Maharashtra total rice growing area was 14.65 lakh/ha, with productivity 32.76 lakh tones (MSSDP 2019). There is need to further enhance the rice production, but several abiotic and biotic stresses are the main constraints. Sakoli is an endemic area for gall midge incidence. Standing water, cloudy weather and drizzling rains favors gall midge buildup. Intensive cultivation of rice has resulted in the frequent occurrence of biotic stresses that formed as major constraints in rice production. Weather conditions influence the various growth and development stage of crop and indirectly, the incidence of pests and diseases (Yoshida and Parao, 1976). A combination of cultural practices like early planting, synchronous planting, crop rotation and early maturing varieties protect the rice crop against most insect pest and diseases (Litsinger et al. 1987). In recent times climate change had impact on the onset and progress of the monsoon across the country. Global climate change has already made India hotter and drier since the middle of the twentieth century, with more droughts, cloudbursts, floods, rising sea levels, stronger cyclones and a change in the monsoon pattern. This has influenced the June-September monsoon on which so many Indian farmers continue to depend. The rainfall has become less and more uneven during the rainy season disrupting the normal planting schedule. Farmers are being forced to adopt alternative planting dates to mitigate the climate variability. Early and delaying of onset of monsoon has affected farmer's planting of rice crops.

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Similarly, variability in the distribution pattern of rainfall, unavailability of water source and subsequent release of water from canals is forcing farmers to plant rice at different dates. These changes in sowing and planting dates have a profound influence on the incidence of biotic stresses mainly insect pests. Earlier efforts have been made to study the influence of the date of planting on insect pest incidence and population dynamics in rice crop by ICAR- Indian Institute of Rice Research, Hyderabad and others (Karuppuchamy and Gopalan, 1986, Umeh,1998, Magunmder *et al.,*2013, Singh *et al.,* 2013, Tetarwal et al*.,* 2014 and Anonymous, 2016, 2017, 2018, 2019 and 2020b). Hence, it is important to know the insect pest incidence in relation to crop phenology and planting dates and to relate pest dynamics with abiotic factors to provide advisories to farmers. Keeping this in view, the trial on the effect of planting dates on insect pest incidence was conducted at the Agriculture Research Station, Sakoli, Dist. Bhandara (M.S.) during *kharif*2016 to 2020.

MATERIAL AND METHODS

Most popular variety PKV HMT was planted at three dates *viz.*, normal planting - as per the recommended package of practices of the region, early planting - 20 days earlier to normal planting and late planting - 20 days later than the normal planting. The date of sowing was decided on the basis of an expected date of onset of monsoon in the respective years. The field experiment consisted of three treatments and ten replications were laid out in randomized block design (RBD) with spacing of 20 cm X 15 cm and plot size of 500 m^2. 1500 m^2 area was divided into 3 plots of 500 m^2. Each time nursery sowings and plantings were done separately in 500 m^2 area. Observations on insect pest incidence were recorded at 10 days interval starting from 10 days after transplanting. Incidence of gall midge, stem borer, leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper was recorded in all the plantings on PKV HMT grown in this trial.

RESULTS AND DISCUSSION

Five year cumulative pooled results indicate that, there was no much more difference found in the incidence of stem borer i.e. dead hearts (DH) and white earheads (WE) in different planting dates.

Mean dead heart damage was low in early planting (5.16 %) followed by normal planting (5.85 %) and high in late planting (6.77%), while white ear damage was low in late planting (5.85 %) followed by early planting (7.45 %) and high in normal planting (8.13 %) (Table 1). High mean incidence of gall midge (2.92 – 17.71% silver shoots) was observed with significantly higher damage in late planting (17.71 % silver shoots) followed by normal planting (9.90 % silver shoots) and lowest in early planting (2.92 % silver shoots) (Table 2). Low mean incidence of leaf folder (1.78 – 2.25 % damage), brown plant hopper (3.74 – 5.06 no.hill^{-1}), white backed plant hopper (1.31 – 1.59 no.hill^{-1}), and green leaf hopper (1.11 – 1.50 no.hill^{-1}) were recorded in different plantings (Table 3 and 4). Early planting (46.06 q ha^{-1}) yielded more, was superior to other treatments and followed by normal planting (41.17 qha^{-1}) and late planting (23.03 q ha^{-1}). 23.03 and 18.14 q ha^{-1} higher yield was recorded in early planting as compared to normal and late planting, respectively. Similarly, yielded 100 and 78.76 per cent more in early planting as compared to normal and late planting, respectively.

Occurrence of insect pests on paddy crop is influence by date of planting. In case of late transplanting the surrounding crop might have completed its susceptible growth stages and the entire pest inoculum would be feeding or confining to the late transplanted crop (Rani and Pillai, 2012). This might be the reason for higher gall midge incidence in late-planted rice. Varying the planting time of crops worked as a means of cultural control by creating asynchrony between crop phenology and insect pests phenology which can retard the colonization (Ferro, 1987). A higher population was found in later-stage crop. It may be occurred due higher succulency in leaves, stems or tillers. The result of the present investigation showed that low incidence of gall midge was exhibited in early planting. Similar findings of reduced pests and diseases in early maturity variety and early transplanting date have been reported by Litsinger *et al.* (1987). Low incidence of pests and diseases in early planting date is also reported by Moniperumal (1989). Souleymane Nacro *et al.* (2006) showed that the later the planting date, the higher the damage caused by African rice gall midge (*O. oryzivora)*. Yield losses were correlated to the observed damage. Trials conducted by ICAR- IIRR, Hyderabad during *kharif* 2016 was support to the present findings where gall midge incidence was reported with highest damage of 15.84% SS at Titabar in late planting (Anonymous, 2016). A similar result was found in the present study. Similarly, Singh *et al.* (2013) revealed that the maximum damaged of stem borer and leaf folder and population five^{-1} sweeps of leaf folder, green leaf hopper and grass hopper were observed in very late transplanting and least in normal planting in both experimental years. The natural enemies' populations five^{-1} sweeps were highest in normal followed by very late planting rice. Magunmder *et al.* (2013) found that early planted rice had lower pests and natural enemy's population than later-transplanted rice.

Effect of planting dates on insect pest incidence (EPDP) trial was conducted at 18 locations in India during *kharif* 2016. In general, the pest incidence in different dates of planting across locations was low to moderate during *kharif* 2016.

Dead hearts and white ears caused by stem borer, silver shoots caused by gall midge, whorl maggot, case worm, grasshopper, rice skipper, horned caterpillar, BPH, GLH and gundhi bug incidence was high in late planting as compared to early and normal plantings. However, leaf folder incidence was relatively high in early and normal plantings as compared to late planting. WBPH incidence was relatively high in normal planting as against early and late plantings. (Anonymous, 2016).

Effect of planting dates on insect pest incidence (EPDP) trial was conducted at 20

locations in India by ICAR- Indian Institute of Rice Research, Hyderabad during *kharif* 2017. The results revealed that the pest incidence was low to moderate in different dates of planting across locations during *kharif* 2017. Incidence of stem borer, gall midge, leaf folder, whorl maggot, caseworm, thrips, grasshopper, BPH, WBPH, GLH and Gundhi bug was high in late planting compared to early and normal planting (Anonymous, 2017).

A trial on Effect of planting dates on insect pest incidence (EPDP) was conducted

at 21 locations in India by ICAR- Indian Institute of Rice Research, Hyderabad during *kharif 2018.* Overall, the pest incidence was low in different dates of planting across locations during *kharif* 2018. Incidence of stem borer, gall midge, leaf folder, caseworm, whorl maggot, BPH, WBPH, and GLH was high in late planting compared to early and normal plantings (Anonymous, 2018).

Effect of planting dates on insect pest incidence (EPDP) trial was conducted at 22 locations in India by ICAR- Indian Institute of Rice Research, Hyderabad during *kharif 2019. T*he insect pest incidence was low to moderate in different dates of planting across 22 locations. Incidence of stem borer, gall midge, leaf folder, whorl maggot, hispa, caseworm, BPH, WBPH and GLH was found high in late planting as compared to early and normal plantings (Anonymous, 2019).

Effect of planting dates on insect pest incidence (EPDP) trial was conducted at 20 locations in India by ICAR- Indian Institute of Rice Research, Hyderabad during *kharif 2020.* Insect pest incidence was low to moderate in different planting dates across 20 locations. Incidence of stem borer, gall midge and foliage feeders like leaf folder, whorl maggot, hispa, caseworm and thrips, sap sucking insects like BPH, WBPH and GLH was observed high in late planting as compared to early and normal plantings (Anonymous, 2020b).

CONCLUSION

From the study carried out during *kharif* 2016-2020 at ARS, Sakoli, the present findings conclude that early planting significantly reduced the incidence of gall midge followed by normal planting and the highest incidence was exhibited in late planting. No significant difference was found in incidence of stem borer in different planting. Low incidence of leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper were recorded in different plantings. Highest yield was exhibited in early planting and followed by normal planting.

Table1: Effect of planting dates on mean incidence of stem borer on Paddy.

Tr. No.	Treatment	Stem Borer											
		Dead heart(%)						White earhead(%)					
		2016	2017	2018	2019	2020	Pooled	2016	2017	2018	2019	2020	Pooled
1	Early planting	3.24 (1.93)	5.10 (2.23)	5.17 (2.26)	4.08 (2.01)	8.21 (2.85)	**5.16 (2.27)**	9.15 (3.03)	13.60 (3.64)	2.17 (1.45)	6.27 (2.50)	6.05 (2.46)	**7.45 (2.71)**
2	Normal planting	5.10 (2.36)	6.18 (2.47)	7.37 (2.71)	4.58 (2.13)	6.02 (2.45)	**5.85 (2.42)**	5.63 (2.37)	9.74 (3.09)	8.63 (2.96)	8.54 (2.92)	8.10 (2.85)	**8.13 (2.84)**
3	Late planting	3.92 (2.08)	3.13 (1.76)	11.13 (3.33)	8.14 (2.85)	7.52 (2.74)	**6.77 (2.60)**	4.84 (2.20)	4.06 (1.70)	3.71 (1.98)	9.79 (3.16)	6.85 (2.62)	**5.85 (2.40)**
	'f' test	Sig	Sig	Sig	Sig	Sig	Sig	NS	Sig	Sig	Sig	NS	Sig
	SE (±M)	0.07	0.09	0.06	0.07	0.07	0.99		0.24	0.22	0.21	0.14	1.09
	CD at 5%	0.20	0.28	0.19	0.19	0.21	2.95		0.72	0.66	0.63	0.41	3.23
	CV (%)	10.20	13.63	7.13	8.85	8.30	129.40		27.39	33.09	23.50	16.82	129.75

Table 2: Effect of planting dates on mean incidence of gall midge and leaf folder on Paddy.

Tr. No.	Treatment	Gall midge(% Silver Shoot)						Leaf folder(% Damage)					
		2016	2017	2018	2019	2020	Pooled	2016	2017	2018	2019	2020	Pooled
1	Early planting	0.88 (0.88)	3.33 (1.80)	0.96 (0.88)	4.02 (1.95)	5.39 (2.31)	**2.92 (1.71)**	2.18 (1.63)	1.22 (1.10)	2.17 (1.46)	1.38 (1.16)	1.95 (1.39)	**1.78 (1.33)**
2	Normal planting	2.37 (1.51)	10.71 (3.26)	7.03 (2.61)	10.33 (3.15)	19.06 (4.36)	**9.90 (3.14)**	2.85 (1.82)	1.28 (1.12)	3.36 (1.83)	2.44 (1.56)	1.31 (1.14)	**2.25 (1.50)**
3	Late planting	6.91 (2.58)	17.09 (4.09)	21.11 (4.58)	30.25 (5.49)	13.20 (3.62)	**17.71 (4.20)**	3.39 (1.97)	1.07 (1.03)	2.60 (1.60)	2.00 (1.40)	1.12 (1.05)	**2.04 (1.43)**
	'f' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	NS	Sig	Sig	Sig	Sig
	SE (±M)	0.11	0.14	0.13	0.14	0.07	1.30	0.04		0.07	0.05	0.03	0.58
	CD at 5%	0.34	0.42	0.40	0.42	0.22	3.87	0.11		0.19	0.16	0.09	1.72
	CV (%)	21.62	14.66	15.67	12.55	6.72	136.48	6.34		12.67	12.05	8.37	129.37

**Figures in parentheses are corresponding values of square root transformation.*

Table 3: Effect of planting dates on mean incidence of plant hoppers on Paddy.

Tr. No.	Treatment	Brown Plant Hopper (No./hill)						WBPH(No./hill)					
		2016	2017	2018	2019	2020	Pooled	2016	2017	2018	2019	2020	Pooled
1	Early planting	1.17 (1.08)	1.06 (1.03)	2.39 (1.54)	6.35 (2.52)	7.74 (2.78)	**3.74 (1.93)**	1.21 (1.10)	1.01 (1.00)	1.10 (1.05)	1.79 (1.34)	1.42 (1.19)	**1.31 (1.14)**
2	Normal planting	1.62 (1.27)	2.98 (1.73)	4.98 (2.23)	7.66 (2.77)	8.06 (2.84)	**5.06 (2.25)**	1.29 (1.14)	1.19 (1.09)	1.59 (1.26)	2.23 (1.49)	1.46 (1.21)	**1.55 (1.25)**
3	Late planting	1.09 (1.05)	3.26 (1.80)	5.23 (2.28)	7.88 (2.80)	7.80 (2.79)	**5.05 (2.24)**	1.14 (1.07)	1.14 (1.06)	1.96 (1.40)	2.15 (1.47)	1.58 (1.26)	**1.59 (1.26)**
	'f' test	Sig	Sig	Sig	Sig	NS	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (±M)	0.01	0.03	0.03	0.04	0.02	0.88	0.01	0.02	0.02	0.01	0.02	0.50
	CD at 5%	0.04	0.10	0.09	0.13	0.06	2.61	0.04	0.05	0.06	0.03	0.05	1.48
	CV (%)	3.69	6.80	4.94	5.05	2.31	129.43	3.79	5.32	4.96	2.38	4.21	129.23

**Figures in parentheses are corresponding values of square root transformation.*

Table 4: Effect of planting dates on mean incidence of green leaf hoppers and yield of Paddy.

Tr. No.	Treatment	Green Leaf Hoppers (No./hill)						Yield(q/ha)					
		2016	2017	2018	2019	2020	Pooled	2016	2017	2018	2019	2020	mean
1	Early planting	0.44 (0.66)	1.02 (1.01)	1.05 (1.02)	1.53 (1.24)	1.51 (1.23)	**1.11 (1.05)**	40.08	37.16	66.87	59.00	27.20	**46.06**
2	Normal planting	0.60 (0.77)	1.02 (1.01)	1.48 (1.22)	1.76 (1.33)	1.72 (1.31)	**1.32 (1.15)**	57.00	27.20	45.50	51.37	24.80	**41.17**
3	Late planting	0.58 (0.76)	0.97 (0.98)	2.07 (1.44)	1.86 (1.36)	2.03 (1.42)	**1.50 (1.22)**	24.76	18.04	20.67	24.50	27.20	**23.03**
	'f' test	Sig	NS	Sig	Sig	Sig	Sig	-	-	-	-	-	-
	SE (±M)	0.02		0.02	0.01	0.01	0.47						
	CD at 5%	0.05		0.06	0.04	0.04	1.39						
	CV (%)	7.71		5.14	2.91	3.46	129.36						

**Figures in parentheses are corresponding values of square root transformation.*

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