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Effect of planting dates on incidence of rice leaf folder and its impact on grain yield in north eastern coastal plains of Odisha

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Abstract
The present study was conducted at Krishi Vigyan Kendra Jajpur, Odisha India, during Kharif 2015&16 with an objectives to study on the effect of planting dates on incidence of rice leaf folder *Cnaphalocrocis medinalis* G. and its impact on grain yield in rice crop. The data on leaf folder incidence was recorded in all two seasons trials, the experiments comprise of five dates of planting i.e. 1st July., 15th July, 1st August,15th August and 30th August.in trial plots in KVK instructional farm in Randomized block design and it replicate four times with one common variety (MTU-7029). Data has been recorded on leaf folder incidence at 10 days interval from date of transplanting till Doughing stage and the grain yield at time of harvesting. It was evident from the data given in Table -3 that significant differences existed among transplanting dates pertaining to percentage of Leaf Folder Incidence (LFI). Rice crop transplanted late; 30th August was heavily infested by leaf folders (15.42%), However minimum infestation by leaf folders was recorded (7.83%) in early transplanted crop i.e.1st August The rice crop planted on 1st July proved to be the best for obtaining maximum grain yield (42.37Qt/ha) and the lowest yield in late planted crop.

Keywords: Planting dates, leaf folder incidence and yield

Introduction
Rice (*Oryza sativa*) belonging to the family Graminae is being cultivated in different agro climatic regions along breadth and length of the country as upland, medium land and low land rice., it is one of the most important food crops with regard to human nutrition and caloric intake not only in India but the world too. It is the staple food for more than sixty per cent of the world`s population and the total area under rice cultivation in India is 44.6 million hectares with a production of 90 million tonnes Ghule *et al*.2008 [1]. It constitutes 52 per cent of total food grain production and 55 per cent of total cereal production Singh, 2013 [2]. Rice is grown in all the continents except Antarctica, occupying 158.8 million hectare in 111 countries in the world (Agricultural statistics at a glance, 2017) [3], out of which Asia accounts for 90 per cent and America, Australia, Africa and Europe cover the rest 10 per cent with a production of 685 million tonnes and productivity of 4328kg/ha, Agricultural statistics at a glance, 2017 [3]. Rice productivity of 3.01 t/ha of India is lower than China (6.26t/ha) and Srilanka (3.51t/ha) and much lower than 9.80 t/ha in Egypt Krishna *et al*., 2008 [4].

India ranks first in area with 44.6 million hectare of land under rice cultivation and second after China in production of rice with a production of 104.31 million tonnes that shares 19.51 per cent of world rice production with average productivity of 2404 kg/ha. It contributes to 65 per cent of the total population with 45 per cent cereal production of India and there by hold the key position to sustain food sufficiency in the country Agricultural statistics at a glance, 2017 [3]. Presently rice in Odisha is grown over an area of 4.03 million hectares, which accounts for 89 per cent of the area under cereals and contributes about 92 per cent of total cereal production in the state Das *et al*., 2012 [5].

The North Eastern coastal plains of Odisha is severely affected by rice leaf folder *Cnaphalocrocis medinalis* Guenee. Intensive cultivation of rice (both Kharif and Rabi) has resulted in frequent occurrence of biotic stress that formed as major constraints of production. The sowing time of the rice crop is important for three major reasons. Firstly, it ensures that vegetative growth occurs during a period of satisfactory temperatures and high levels of solar radiation. Secondly, the optimum sowing time for each cultivar ensures the cold sensitive stage occurs when the minimum night temperatures are historically the warmest. Thirdly, sowing on

time guarantees that grain filling occurs when milder autumn temperatures are more likely, hence good grain quality is achieved Farrell *et al*., 2003 [6]. Sowing date also has a direct impact on the rate of establishment of rice seedling Tashiro *et al*., 1999 [7]. Early and delaying of onset of monsoon has affected the farmer's planting of rice crop. Similarly uneven distribution pattern of rainfall, unavailability of water source in canal is forcing farmers to planting in different dates which have profound influence of incidence of biotic stress mainly insects pests. Earlier efforts have been made for studying the incidence of insects pest of rice by ICAR –AICRP [8], Karuppuchamy and Gopalam,1986, [9] Mangumnder *et al*. 2013 [10], Singh *et al*., 2013 [3], Tetarwal *et al*., 2014 [11]. Here the study has been conducted with objectives to study the effect of dates of planting on incidence of leaf folder and its impact on grain yield in rice crop.

Materials and Methods

To determine the effect of dates of planting on the incidence of leaf folder and their natural enemies was studied at KVK, Jajpur Instructional farm in the wet season 2015&16. The rice variety Swarna (MTU-7029) was sown at 15 days interval i.e. June 7th, 22nd June, 7th July, 22nd July and 7th August. Each sowing date was done Randomized Block Design with five replication and the crop was grown under unprotected condition. The 25 days old seedlings were transplanted in the field @ 3-4 plants hill.$^{-1}$ on first transplanting date (1st July), second transplanting date (15th July), third transplanting date (1st August), fourth transplanting date (15th August) and fifth transplanting was done in 30th August. Plant spacing was 20 × 15 cm; 20 cm spacing between lines and 15 cm spacing between hills were maintained. The size of each plot was 5 X 4 m^2 (Twenty meter square). Intercultural operations such as weeding, irrigation and other activities were done as and when necessary for sustainable production. The recommended dose of fertilizer (N:P:K) i.e. 80:40:40 kg/ha was applied to the crop in two splits i.e. 50 % N, full dose of P_20_5 and K_20 during final land preparation and remaining 50% N(in two spilt dose 25% each) at the tillering stage time of panicle initiation. No chemical insecticides were used for allowing the pest and natural enemies to multiply. Observation on leaf folder infested leaves was recorded at once at peak infestation of each date sowing and grain yield at harvest.

$$\text{Incidence (\%)} = \frac{\text{No. of damaged leaves}}{\text{Total number of leaves}} \text{ X } 100$$

Table 1: Lay out plan of field investigation during *Kharif*, 2015 and *Kharif*, 2016

Design treatments	RBD (Randomized block design) Five date of sowing and transplanting of rice, each at 15 days intervals.
Replication	4
Spacing (plant to plant)	15 cm
Spacing (row to row)	20 cm
Plot size	5 x 4 m
N:P:K	80:40:40 (As per OUAT recommendation) MTU-7029

Table 2: Treatments details of planting schedule

Sl. No.	Dates sowing	Date of transplanting	Date of harvesting
D1	07.06. 2015 & 2016	01.07.2015 & 2016	02.11. 2015 & 2016
D2	22.06. 2015 & 2016	15.07.2015 & 2016	15.11. 2015 & 2016
D3	07.07. 2015 & 2016	1.08. 2015 & 2016	25.11. 2015 & 2016
D4	22.07. 2015 & 2016	15.08. 2015 & 2016	05.12. 2015 & 2016
D5	07.08. 2015 & 2016	30.08. 2015 & 2016	15.12. 2015 & 2016

Table 3: Effect of date of transplanting on the incidence of Rice leaf folder *Cnaphalocrocis medinalis* G. and Grain yield in North Eastern Coastal plain of Odisha during 2015 &16.

Sowing Date/Planting Date	leaf folder damaged incidence (%) recorded at peak infestation(pooled)			Grain yield (Kg/Ha)		
	Wet Season			Wet Season		
	2015	2016	Mean	2015	2016	Mean
01.07.2015 & 2016	8.23(2.87)	7.43(2.73)	7.83(2.79)	4200	4275	4237.5
15.07.2015 & 2016	10.85(3.29)	9.35(3.06)	10.1(3.18)	4050	4090	4070
1.08. 2015 & 2016	13.21(3.63)	12.85(3.59)	13.03(3.61)	3800	3890	3845
15.08. 2015 & 2016	14.98(3.87)	14.42(3.80)	14.7(3.84)	3650	3710	3680
30.08. 2015 & 2016	15.62(3.95)	15.22(3.90)	15.42(3.93)	3600	3650	3625
SEm. (±)	0.10	0.07		16.91	17.50	
C.D. (P=0.05)	0.30	0.22		51.18	52.95	
CV	1.59	1.25		0.88	0.89	

Figures in parentheses are square root transformed values.
DAS= Days After Sown

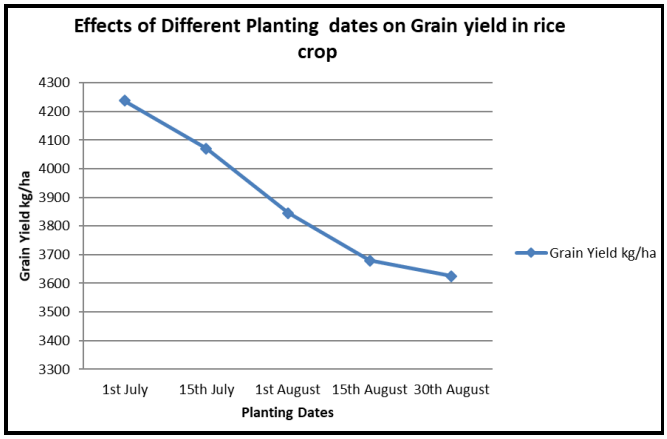

Fig 1: Effect of different planting dates on grain yield in rice crop

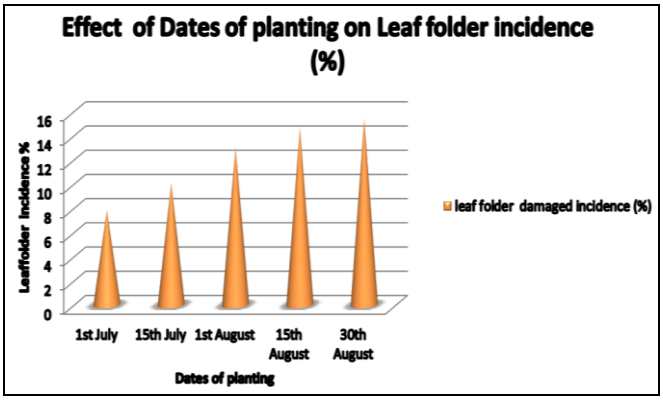

Fig 2: Effect of different planting dates on leaf folder (*Cnaphalocrocis medinalis* G) incidence

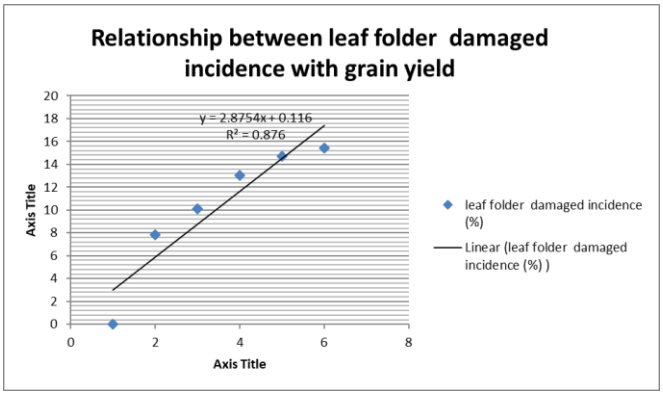

Fig 3: Relationship between leaffolder incidence % and yield (Fig. 3) gave a negative correlation (y = 2.8754x+0.1160 R^2 = 0.876), indicating the increase of leaffolder incidence causes a progressive loss in yield.

Results and Discussion

From the analysis of mean incidence of leaf folder during the study period i.e. kharif 2015 and 2016 the result revealed that the effect of transplanting dates on the incidence of rice leaf folder revealed that the leaf infestation ranged between 8.23 % and 15.62 per cent when the transplanting of rice was extended from 1st July to 30thAugust.Lowest infestation (8.23%) was recorded in the 1st July transplanting and highest infestation (15.62%) when it was transplanted 30th August. It is evident from the data presented in Table-3 that there was progressive increase in the level of infestation with every delay in transplanting beyond first fortnight of July. The Grain yield varied from 4237.5kg/ha to 3650kg/ha in different dates of transplanting. Highest grain yield of 4250 kg/ha was obtained when the crop was transplanted 1st July, while such operation was delayed to late August recorded lowest grain yield of 3650kg/ha. Every delay in the transplanting time caused progressive reduction in grain yield. However, a significant decrease in grain yield was recorded when transplanting was delayed beyond July 31st. In order to conform the results of the previous year the experiment was repeated in the wet season of 2016. The result showed that a similar trend like the previous year. A progressive increase in the leaf folder infestation with every delay in transplanting time and a corresponding decrease in grain yield was observed (Table-3). (Fig no -1). From the results it becomes clear that transplanting dates of rice beyond mid July significantly reduces grain yield.

Two year cumulative pooled results indicated that, high mean incidence of leaf folder (7.83 to15.42%) was observed with significantly higher damage in late transplanting (15.42%) followed by the transplanting made on 1st July (Table-3). From the analysis of mean incidence of leaf folder the result revealed that transplanting on 1st July significantly reduced the incidence of leaf folder infestation followed by 15th July and highest incidence was recorded or exhibited in late transplanting i.e. 30th August. Occurrence of insect pest on paddy crop is influenced by date of transplanting (Fig no-2). In case of late transplanting the surrounding crop might have completed their susceptible growth stages and the entire pest inoculum would be feeding or confining to the late transplanted crop Rani and Pillai. *et al*, 2013 [12]. This might be reason for the higher leaf folder incidence in late transplanted rice crop. Varying the transplanting time of crops worked as means of cultural control by creating asynchrony between crop phenology and insect pest phenology which can be retard the colonization Ferro *et al*, 1987 [13]

The result of the present investigation showed that low incidence of leaf folder in rice was exhibited in early transplanted crop i.e. (1st July). Similar finding of low incidence of rice leaf folder in early transplanted crop is reported by Maniperunal 1989 [14]. Singh *et al*. 2013 [3] revealed that the maximum damaged of leaf folder was observed in very late transplanting and least damaged in early transplanting in both the experimental years. Magumnder *et al*. 2013 [10] found that early planted rice crop had lower pest and natural enemies than later transplanted rice (after 30th August). Early transplanting was beneficial for reduction of damage caused by Leaf folder, However the higher grain yield was obtained in Early transplanting i.e. 1st July and lowest in crop planted during last part of the August i.e. 30th August. In early transplanted crop when the infection stage of pest and microbes are over, the inoculums would be finding a place in a late transplanting crop Rani and Pillai, 2012 [12].

The higher insect pests attack in late planted rice has already been reported by Bambhro 2000 [15] and Hassan *et al*. 2003 [16]. These results are in concurrence with Aziz Khakwani *et al*. 2006 [17] whereby rice seedlings transplanted early were little infested by the attack of leaf folder. The early transplanted rice has a prolonged growing period; hence, despite inverting in photosynthetic tissues, it diverts more photosynthate towards grain yield. Paddy yield is the ultimate output of rice production and is most desired factor in influencing farmers for recommended rice planting. Paddy yield in the function of interplay of various factors noticeably number of tillers, grains spikes-1 and 1000 grain weight Baloch, 2004 [18]. These findings are in agreement with Hassan *et al*. 2003 [16] who reported increased rice yields in

early transplanted seedlings (June transplantation) as compared to late rice transplanting of July. Conformity to present research findings was also obtained from the results quoted by Baloch 2004 [18] and Pal *et al*. 1999 [19] who concluded that delayed rice transplanting produced lowest yields as compared to seedlings transplanted early in the season i.e., the month of June. Similarly Singh *et al*. 2013 [20] revealed that maximum leaffolder incidence was observed in very late planting and least in normal planting. The early sowing dates produce a high grain yield more than later ones, delaying sowing date from 15th July decrease the grain yield (t/ha), Khalid *et al*.2015 [10].

Conclusion

From the findings of present research, it has been concluded that rice transplanted at early dates favours high paddy yields, lowest leaf folder incidence, Hence early transplanting appears to be a promising way to improve grain yield in rice from ecological and economic perspectives in the North Eastern Coastal plains region of Odisha.

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