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Studies on phenological developments of different rice genotypes at different growing environments

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Abstract
Studies on phenological developments of different rice genotypes at different growing environments were carried out *kharif* 2019 at Student Instructional Farm of A.N.D.U.A.&T, Kumarganj, Ayodhya (U.P.). The experiment was layout Randomized Block Design (RBD) with four replications. The treatments comprised of three crop growing environment i.e. 5th July (D_1), 15th July (D_2) and 25th July (D_3) with three genotypes i.e. NDR-97 (V_1), SARJOO-52 (V_2) and BPT-5204 (V_3). The results revealed that crop growing environment on 5th July (D_1) took some more days to reach harvest stage at all genotypes *viz*.- NDR-97 (87 DAT), SARJOO-52 (110 DAT) and BPT-5204 (132 DAT) followed by 15th July (D_2) crop growing environment at all genotypes *viz*.- NDR-97 (85 DAT), SARJOO-52 (108 DAT) and BPT-5204 (129 DAT) and 25th July (D_3) crop growing environment on takes minimum days to reach at harvest in case of all genotypes *viz*.- NDR-97 (82 DAT), SARJOO-52 (106 DAT) and BPT-5204 (126 DAT).

Keywords: Phenophasic duration, Genotypes, crop growing environment, rice

Introduction
Rice (*Oryza sativa* L.) is one of the most important cereal crops of the world, representing the staple food for more than half of the world population (Confalonieri and Bocchi, 2005) [4]. Rice belong to Poaceae family originated from South East Asia, where more than 90 percent of world's rice is produced and consumed (Li and Xu, 2007) [6]. Rice is grown throughout the year in our country. It is essentially a short day C_3 plant. Here are number of situation and method of sowing of rice, *viz.* upland rice, low land rice, rainfed rice, irrigated rice, directed seeded, transplants, SRI methods etc. In India it is mainly grown in the *kharif* or *rabi* season, or both. For more than half of the humanity "rice is life". Considering its importance position, the United Nation designated year 2004 as the *"International Year of rice.* The rice is cultivated on the largest areas in India. the duration of growth stage of any particular species was directly related to temperature and it could be predicted using the sum of daily air temperature. Temperature is an important environmental factor that influences the growth and development, phenology and yield of crop (Bishnoi *et al*., 1995) [1]. Hence, it becomes imperative to have the knowledge of exact duration of various phenological stages of crop in a particular growing environment and their impact on its yield). Phenological development from sowing to physiological maturity is dependent on the accumulation of thermal units above threshold or base temperature. The heat unit requirements of each stage of crop need to be satisfied before the onset of next stage. The duration of each phenological stage is influenced by temperature which has direct impact on yield. Crop phenology can be used to specify the most appropriate date and time of specific development process. Rice is extremely sensitive to higher temperature during reproductive stage especially flowering and anthesis. The elevated temperature at the time of flowering and maturity determines the yield per seed of the genotypes. Under high temperature stress, the response of genotypes depended on developmental stage, but highest sensitivity was recorded at reproductive stage. The time of sowing, days to flowering (duration group), heat escape (early morning flowering) and inbuilt tolerance were the crucial factors in determining the performance of genotypes to varying temperature. Hence, it is necessary to select genotypes by keeping in view the above factors for different temperature stress within and across the environment (Raju *et al.* 2013) [7].

Materials and Methods

A field experiment was conducted during *Kharif* season of 2019 at Student Instructional Farm of A.N.D.U.A.&T, Kumarganj, Ayodhya (U.P.) The geographical situation of experimental site lies at latitude 26° 47'North longitude 82° 12' East and altitude of 113 meter from mean sea level in the Indo -genetic alluvium of Eastern Uttar Pradesh. Studies on phenological developments of different rice genotypes at different growing environments. Experiment was conducted within Randomized Block Design and replicated four times. The treatments comprised of three crop growing environment i.e. 5th July (D_1), 15th July (D_2) and 25th July (D_3) with three genotypes i.e. NDR-97 (V_1), SARJOO-52 (V_2) and BPT-5204 (V_3). After making individual experiment units, the amount of fertilizer was applied as per treatment through urea, DAP and MOP. One third (1/3) dose of nitrogen and total phosphorous and potash were applied as basal application before puddling and incorporated in the top 15 cm soil. Remaining dose of nitrogen was applied as top dressing in two equal doses each at tillering and panicle initiation stages. The soil of the experimental field was silty loam in texture and medium in fertility having pH 8.5. Total numbers of days taken from transplanting to different phenophases of rice crop were recorded as to know the effect of various treatments on the phenophasic duration of crop.

Results and Discussion

Days taken to different phenophases of rice

The data regarding days taken by different rice genotypes reach different phenological stages i.e. tillering, panicle initiation, 50 per cent flowering, milking, dough and harvest under three crop growing environments are shown in Table-1 and fig-1. Crop growing environment on 5th July (D_1) took some more days to reach harvest stage at all genotypes *viz*.- NDR-97 (87 DAT), SARJOO-52 (110 DAT) and BPT-5204 (132 DAT) followed by 15th July (D_2) crop growing environment at all genotypes *viz*.- NDR-97 (85 DAT), SARJOO-52 (108 DAT) and BPT-5204 (129 DAT) and 25th July (D_3) crop growing environment on takes minimum days to reach at harvest in case of all genotypes *viz*.- NDR-97 (82 DAT), SARJOO-52 (106 DAT) and BPT-5204 (126 DAT). This was might due to the early sown crop takes a greater number of days to each phenological stage as compared to late sown crop especially in vegetative phase between tillering to panicle initiation stage. Analysis of variance shows sufficient variation among genotypes in all crop growing environments and yield contributing characters phenological events also decreased by some days under delayed crop growing environment. These statements agree with the finding of Dakhore (2003) [5].

After that there is a lot of variation to reach different phenophases of rice. This might be due to variation in weather condition *viz.* temperature and relative humidity in the atmosphere during the crop growth and Phenophasic change based on change with growing environment. The possible reason is that the genetic makeup of genotypes which are identical for each genotype. Similar result was found by Biswas (2008) [2] reported that the early transplanting took a greater number of days for maturity as compared to late transplanting. Sharma *et al.*, (2011) [8] also reported that the early transplanting took a greater number of days for maturity as compared to late transplanting.

Table 1: Days taken to different phenophases as affected by different treatment of rice.

Transplanting Date	Tillering	Panicle Initiation	Days to 50% Flowering	Milking	Dough stage	Harvest stage
NDR-97						
05-July-19	38	60	74	82	85	87
15-July-19	36	58	73	80	83	85
25-July-19	31	51	65	70	76	82
SARJOO-52						
05-July-19	44	61	79	89	101	110
15-July-19	42	59	78	88	98	108
25-July-19	41	60	76	91	97	106
BPT-5204						
05-July-19	47	71	90	108	120	132
15-July-19	46	72	88	106	119	129
25-July-19	45	69	87	109	122	126

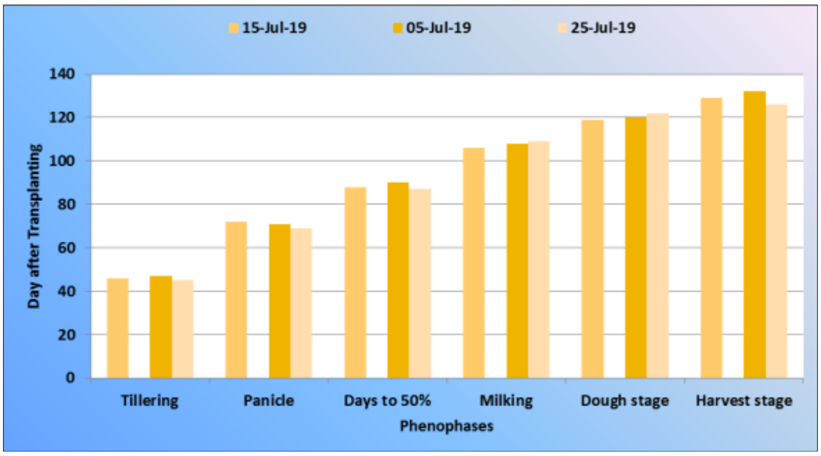

Fig A: SARJOO-52

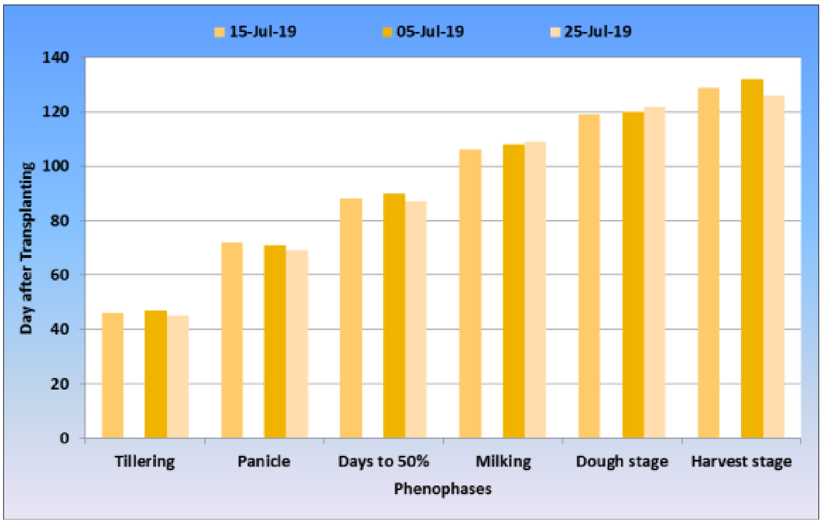

Fig B: NDR-97

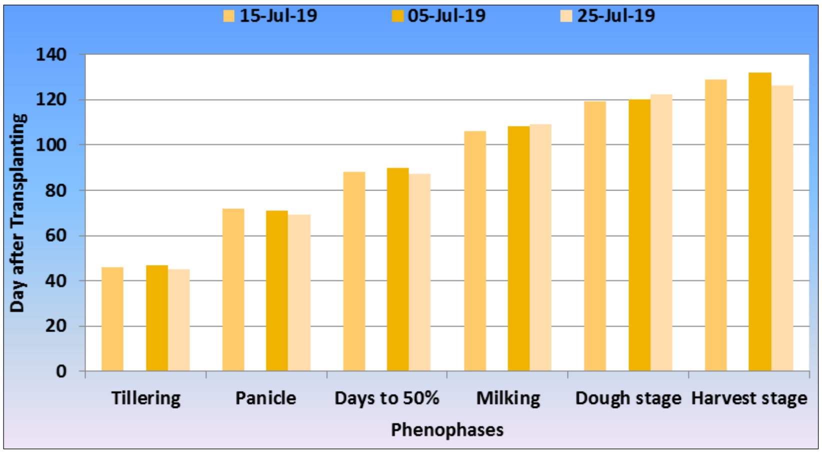

Fig C: BPT-5204

Fig 1: Days taken to different phenophases as affected by different treatment of rice.

Conclusions

Conclusively, different crop growing environment and rice genotypes influenced to the days taken to phenophases. Days to attain harvest stage in all the genotypes *viz.* NDR-97, SARJOO-52, BPT-5204 were maximum under first growing environments (87 days, 110 days and 132 days respectively) followed by second growing environments (85 days, 108 days and 129 days respectively) and third growing environments (85 days, 106 days and 126 days respectively). Among the varieties, maximum days taken to maturity were recorded with BPT-5204 (132 days). The duration of the mid transplanted (D_2) rice was shortened by 22, 21 and 20 days due to delayed transplanting in BPT-5204, NDR-97 whereas these genotypes was shortened by 23, 23 and 24 days in duration of mid growing environments condition (D_2).

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