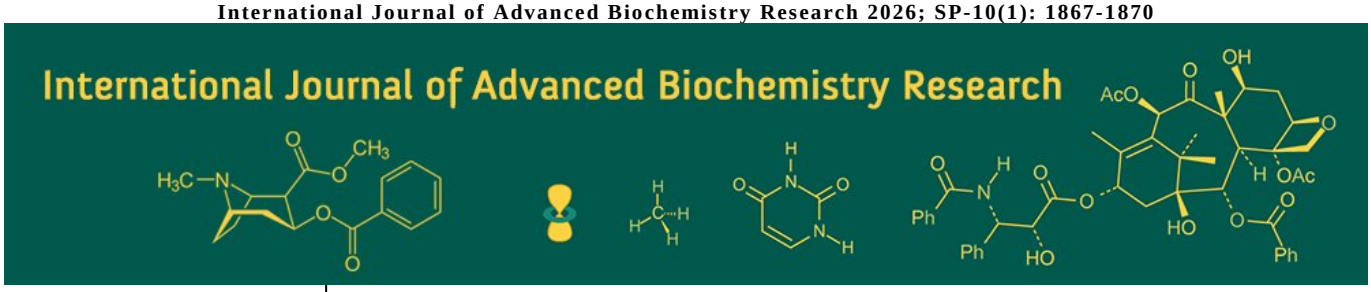

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Comparative study of growth and yield attributes of different paddy cultivars under Tarai region of Uttar Pradesh

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Abstract
Paddy is a predominant kharif crop of Tarai region of Uttar Pradesh which plays a major role in augmenting the income of small and marginal farmers of tarai region of Uttar Pradesh. One of the major constraints of low productivity of paddy is non-adoption of improved package of practices. In this view, a study was carried out at Krishi Vigyan Kendra, Kushinagar farm during the kharif season 2015-16 with ten high yielding varieties of paddy under three categories, scented fine category viz. HUBR-10-9(V_3), HUBR-2-1(V_1), HUR-4-3(V_7), P-1121(V_{10}), P-1612(V_6), fine category viz. BPT-5204(V_8), HUR-36(V_5), HUR-3022(V_2) and coarse category viz. P-44(V_9), Saryu-52(V_4). The experiment was laid out in Randomized Complete Block Design with three replications. The observation were recorded on growth attributing traits viz. plant height (cm), number of tillers per sq.mt., leaf area index and dry matter of plant (g per sqm.) and yield attributing traits viz. Number of panicles per plant, panicle length (cm), number of grains per panicle, number of fertile grains per panicle, grain yield (q/ha), straw yield (q/ha) and grain: straw ratio. Good agricultural practices (GAP) were applied to raise healthy paddy crop. Maximum grain yield was recorded under V_4 (59.5 q/ha) which was statistically at par with V_3 (57.5 q/ha), V_7 (55 q/ha), V_9 (59.33 q/ha) and significantly superior than rest other varieties, while under scented group V_3 recorded highest yield (57.5 q/ha) and under fine rice group V_7 recorded highest yield (55 q/ha) both V_3 and V_7 are at par with V_4. Maximum straw yield was recorded under V_9 (70.5 q/ha) which was statistically at par with V_3 (70.2 q/ha), V_4 (70 q/ha), V_7 (65 q/ha) and significantly superior than rest other varieties. Grain: straw ratio was maximum recorded under V_4, V_7 and V_9 (0.85) which was statistically at par with rest other varieties. Although Saryu-52 is predominant paddy variety in this region and its yield was found maximum but it is closely related to P-44 (under coarse grain category). So it can be replaced by P-44. Under fine category BPT-5204 is predominant paddy variety in this region but its yield is poor and badly affected by draught and diseases, so under fine category it could be replace by HUR-3022 and under scented group HUBR-10-9 could be promoted in this region.

Keywords: Paddy, growth attributes, yield, Tarai region

Introduction
Paddy is one of the major food grains of India. India is regarded as the world's largest producers of brown and white rice thereby accounting for 20% of the whole world's rice production. It occupies about 23.3% of gross cropped area of country. It plays a vital role in national food security. Rice contributes of about 43% of total food grain production and 46% of total cereal production of country [19].

Paddy is a tropical plant, it flourishes comfortably in hot and humid climate. It is fundamentally a kharif crop in India. It demands temperature of around 25 degree Celsius and above and rainfall of more than 100cm. Paddy is also grown through irrigation in those areas that receives comparatively less rainfall. In India, states located in the Eastern and Southern parts cultivate the majority of rice. West Bengal is the leading rice producer in India which is followed by Uttar Pradesh, Telangana, Andhra, Punjab, Orissa, Bihar, Chhattisgarh, Tamil Nadu, Assam and Haryana.

Paddy is the major crop in Uttar Pradesh and is grown in about 5.81mha and production 13.27mt, which comprises of 11.75% of total paddy in India [6]. There are numerous number of paddy varieties which are developed considering the needs of the crop to grow in the possible manner. Various draught resistant varieties are also developed and needs less water

and grows faster as compared with other rice varieties. With this brief overview, the present study was taken up to compare the growth and yield attributes of different paddy cultivars in tarai region of Uttar Pradesh.

Materials and Methods

The present investigation consisting of 10varieties of paddy under three categories, scented fine category viz. HUBR-10-9, HUBR-2-1, HUR-4-3, P-1121, P-1612, fine category viz. BPT-5204, HUR-36, HUR-3022 and coarse category viz. P-44, Saryu-52was carried out during kharif season 2015-16. The experiment was laid out in Randomized Complete Block Design with three replications. The climate of Kushinagar is of sub-tropical and semi-arid type with hot and humid summer and cold winter and falls under the agro-climatic zone-IV and north eastern plains sub zone of Uttar Pradesh. Weather conditions prevailing during both rice growing seasons were different. The soil of experimental field was loam. All the recommended agronomic practices were followed for paddy cultivation. Sowing of paddy in nursery for transplanting of all 10 varieties was done on same date. 2-3 healthy seedlings of 21-days old were transplanted/hill at a spacing of 20cm × 15cm. Full dose of phosphorus and potash was applied at the time of transplanting and rest half dose of Nitrogen was applied in two splits i.e. at 21 days after transplanting and at flowering stage. Irrigation was done regularly as per requirement. At the growth stage, observations were recorded for plant height, no. of tillers per meter square, LAI and dry matter of plant per meter square at 30 days after transplanting, 60 days after transplanting, 90 days after transplanting and at harvest. Observation on yield attributes viz. no. of panicles per plant, panicle length, total no. of grains per panicle, no. of fertile grains per panicle, grain yield, straw yield and grain: straw ratio were recorded at harvest. For the observation one square meter area was taken from each replication.

Results

Results of growth attributes of paddy were shown in Table No. 1. These results showed that at harvest maximum plant height was recorded under V_5 (128.50cm) which was statistically at par with V_6 (120.3) and significantly superior than rest of the varieties. Number of tillers per metre square was found maximum in V_2 (321) which was statistically at par with V_1 (306), V_3 (315), V_5 (311), V_{10} (320) and significantly superior than rest other varieties. At harvest Leaf Area Index (LAI) was recorded maximum in V_4 (2.84) which were statistically at par with rest other varieties. Dry matter of plants (m^2) square was recorded maximum in V_4 (1425gm) which was statistically at par with V_3 (1397gm) and V_9 (1420 gm), significantly superior than rest varieties.

Results of yield attributes were shown in Table No. 2. These results showed that maximum panicle per plant was observed in V_{10} (12.45) which was statistically at par with V_2 (11.5), V_3 (11.1), V_4 (12.07), V_5 (11.7), V_6 (11), V_7 (12), V_8 (12.1), V_9 (12.25) and significantly superior than V_1 (10.4). Panicle length was recorded maximum in V_6 (30.6cm) which was statistically at par with V_1 (27.06cm), V_2 (26.99cm), V_3 (28.82 cm), V_4 (28.75cm), V_{10} (27.5cm) and significantly superior than rest other varieties. Maximum number of grains per panicle and number of fertile grains per panicle was recorded under V_5 (294) and (272.6) respectively, which was statistically significant superior than rest other varieties. Maximum grain yield was recorded under V_4 (59.5 q/ha) which was statistically at par with V_3 (57.5 q/ha), V_7 (55 q/ha), V_9 (59.33 q/ha) and significantly superior than rest other varieties, while under scented group V_3 recorded highest yield (57.5 q/ha) and under find rise group V_7 recorded highest yield (55 q/ha) both V_3 and V_7 are at par with V_4. Maximum straw yield was recorded under V_9 (70.5 q/ha) which was statistically at par with V_3 (70.2 q/ha), V_4 (70 q/ha), V_7 (65 q/ha) and significantly superior than rest other varieties. Grain: straw ratio was maximum recorded under V_4, V_7 and V_9 (0.85) which was statistically at par with rest other varieties.

Discussion

The growth attributes viz. plant height, number of tillers per meter square, leaf area index, dry matter of plant per meter square etc. is a function of interaction between genotype and environment. There is existence of great genetic variability among crop plants to respond to their environment that affect the plant growth and quality. Different cultivars have different nutrient uptake, translocation and assimilation that make one superior to another and make it more nutrient efficient [9]. For better growth and development of the crop optimum nutrient level is also very important [2]. In our present study there was a significant difference in plant height of rice varieties at the NPK level (120:60:40 kg/ha) (Table-1). This might be due to genetic character [1]. The difference in growth attributes indicate that all rice varieties respond differently to the applied nutrient such as nutrient uptake and nutrient use efficiency. The similar finding was reported [8] by using 64 different genotypes of rice they found that different genotypes demonstrated significant and consistent difference for nitrogen uptake and the synthesis of crude protein. Similarly researchers [16] studied dry matter accumulation and the nutrient uptake in a study using six different rice hybrids. Maximum number of tillers per metre square was found in V2 it might be also due to genetic makeup [5, 20]. The optimum level of fertilizer significantly affect the plant height and tiller per hill. At all stages of growth V4 produced hire drive matter than other varieties. This may be attributed to the comparatively more number of tillers and finally yield per unit area in the said variety [10]. The application of fertilizer having more nitrogen results into increased tillering. Leaf area index in the varieties may also be responsible for dry matter production [18]. Few researchers reported that higher is the LAI, higher will be dry matter production [23]. Difference in the rate of DM production among cultivars depends to the large extent on inheritable characteristics of the structure and function of the organs involved in the photosynthesis [20]. LAI of V4 was recorded maximum. LAI is a function of number of shoots per unit area, length, width and number of leaves and these maintain varieties recorded higher value of the set character. Therefore it has higher LAI as compared to rest other varieties. Similar finding was also observed by earlier researchers [7]. The bio-fertilization of rice starting from symbiotic microorganism increase growth parameters and that the number of leaves of the paddy. Good number of tillers results good number of panicles in rice plant, which is a significant component of yield, which occurs during the vegetative stage influenced by various factors [11, 13]. Water stress during tillering reduce the number of tillers and finally the number of panicles [12, 17]. Among the varieties all the yield attributes differed with each other this might be

due to difference in genetic makeup among the varieties. The grain in the rice is a product of number of panicles per unit area, total number of speculates panicles, fertile speculates panicles and test weight [24]. Though the number of panicles in the rice is mainly influenced by genetic makeup but it is also influenced by external factor such as optimum level of fertilizer [15, 16]. Panicles length is also increased buy optimum level of fertilizer although it is mainly governed by genetic makeup [15, 21]. Though number of total grains and fertile grains per panicle is directly related with genetic character but it also affected by other factor such as optimum level of fertilizer water stress etc. Increase in number of total grains and fertile grains per panicles maybe due to better nutrition of panicle primordia which results higher number of total and fertile grains per panicle [5]. The average yield of variety Saryu-52 with recommended dose of fertilizer yielded 59.5 q of paddy grain per hectare was maximum, which was at par with the variety HUBR-10-9 (57.5 q/ha), HUR-4-3 (55 q/ha) and P-44 (59.33 q/ha) and significantly superior than other varieties. This result could be explained by the reason that varieties Saryu-52 had more filled grains than rest other varieties, so that yielded better than rest other varieties. Similar findings were reported by various researchers [18, 22]. Among at par varieties main reason of lower yield may be due to higher percentage of empty grains. Straw yield was recorded maximum in variety P-44 (70.5 q/ha) which was at par with variety HUR-10-9, Saryu-52, HUR-4-3 and significantly superior than rest other varieties at recommended level of fertilizer. This increase was perhaps due to more number of tillers per metre square, height of plant and panicle length, which finally contributed to straw yield.[4, 14]Straw yield is also directly linked with the genetic makeup of varieties. The ultimate partitioning of dry matter among final yield and vegetative part is indicated by grain: straw ratio. The maximum grain: straw ratio that is 0.85 was recorded under Saryu-52, HUR-4-3 and P-44 which was significantly at par with rest other varieties. This may be due to genetic makeup of varieties.

Conclusion

The grain yield of P-44 was found maximum followed by Saryu-52 which is a predominant paddy cultivar in the tarai region. Therefore, P-44 could be used as an alternative to Saryu-52paddy cultivar in the region.

Table 1: Growth attributes of Paddy at 30, 60, 90 DAT and at harvest

Variety	Plant Height (cm)				No. of Tillers/M^2				Leaf area index				Dry matter of Plant (gm/M^2)			
	30 DAT	60 DAT	90 DAT	At Harvest	30 DAT	60 DAT	90 DAT	At Harvest	30 DAT	60 DAT	90 DAT	At Harvest	30 DAT	60 DAT	90 DAT	At Harvest
HUBR-2-1 (V_1)	67.00	87.00	108.40	108.90	307.00	335.00	310.00	306.00	1.70	2.71	3.55	2.73	205.00	720.00	950.00	1200.00
HUR-3022 (V_2)	63.00	84.00	103.00	103.30	323.00	352.00	326.00	321.00	1.64	2.58	3.45	2.64	193.00	674.00	955.00	1215.00
HUBR-10-9 (V_3)	65.00	85.00	105.43	105.70	317.00	346.00	286.67	315.00	1.76	2.73	3.62	2.77	217.00	778.00	1095.00	1397.00
Sarju-52 (V_4)	69.00	90.00	112.30	112.90	280.00	317.00	292.00	287.00	1.90	2.85	3.74	2.84	222.00	790.00	1125.00	1425.00
HUR-36 (V_5)	75.00	99.80	128.10	128.50	314.00	341.00	316.00	311.00	1.69	2.69	3.59	2.69	188.00	657.00	916.00	1166.00
P-1612 (V_6)	72.00	93.90	119.70	120.30	295.00	320.00	296.00	305.33	1.59	2.56	3.35	2.54	159.00	570.00	796.00	1034.33
HUR-4-3 (V_7)	54.80	71.70	83.30	87.70	293.00	322.00	295.00	290.00	1.68	2.65	3.51	2.70	209.00	742.00	1048.00	1320.00
BPT-5204 (V_8)	56.60	73.20	89.00	89.40	292.00	321.00	295.00	289.00	1.82	2.81	3.68	2.71	169.00	605.00	859.00	1078.00
P-44 (V_9)	61.00	81.10	96.30	96.30	296.00	323.00	297.00	292.00	1.85	2.88	3.76	2.79	218.00	779.00	1113.00	1420.00
P-1121(V_{10})	71.90	93.80	119.70	119.10	318.00	353.00	326.00	320.00	1.61	2.59	3.39	2.59	198.00	701.00	983.00	1238.00
S. Em±	2.94	3.42	3.18	3.16	6.52	5.96	7.61	5.58	0.14	0.15	0.16	0.15	6.05	8.47	10.30	10.09
CD (P=0.05)	8.76	10.17	9.45	9.41	19.36	17.72	22.63	16.57	0.41	0.44	0.47	0.44	17.98	25.18	30.60	30.00

Table 2: Yield attributes of Paddy.

Variety	No. of Panicles /pt.	Panicle length (cm)	No. of grains/ Panicle	No. of fertile grains/ Panicle	Grain yield (q/ha)	Straw yield (q/ha.)	Grain: straw
HUBR-2-1 (V_1)	10.40	27.06	244.60	218.40	49.00	60.10	0.82
HUR-3022 (V_2)	11.50	26.99	188.60	176.00	50.00	60.50	0.83
HUBR-10-9 (V_3)	11.10	28.82	208.10	199.00	57.50	70.20	0.82
Sarju-52 (V_4)	12.07	28.75	210.80	172.87	59.50	70.00	0.85
HUR-36 (V_5)	11.70	24.80	294.00	272.60	47.50	58.50	0.81
P-1612 (V_6)	11.00	30.60	242.80	208.40	40.00	50.67	0.78
HUR-4-3 (V_7)	12.00	24.11	210.30	196.20	55.00	65.00	0.85
BPT-5204 (V_8)	12.10	25.19	217.50	211.90	43.00	55.00	0.78
P-44 (V_9)	12.25	24.73	201.63	193.80	59.33	70.50	0.85
P-1121(V_{10})	12.45	27.50	225.70	209.60	50.00	62.50	0.80
S.Em±	0.77	1.74	4.30	4.45	1.78	2.42	0.05
CD (P= 0.05)	2.28	5.18	12.77	13.11	5.30	7.18	0.15

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