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Performance of different sowing times and varieties on yield and soil fertility of rice in Konkan

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Abstract
A field experiment was conducted to assess the "effect of sowing time on yield and soil fertility of different rice varieties under climatic condition of Konkan" on lateritic soil having low to moderate soil fertility status during *Kharif*, 2013 and 2014. The experiment was laid out in split plot design with three main plot *viz*, sowing times and nine sub plot treatments viz., varieties. Thus, there were 27 treatment combinations, replicated three times. The pooled mean of data showed that the significantly higher grain yield was recorded by short duration hybrid Sahyadri-4 sown during 23rd meteorological week followed by same hybrid sown during 24th meteorological week and medium duration variety Jaya sown during 23rd meteorological week. However, in case of straw yield in the pooled data, the significantly higher value was recorded by medium duration variety Karjat-5 sown during 23rd meteorological week followed by same variety sown during 24th meteorological week. In respect of soil fertility, higher values of nitrogen, phosphorus and potassium content and subsequently higher uptake were recorded due to the sowing during 23rd meteorological week as compared to remaining sowing times. Similarly, the short duration hybrid Sahyadri-4 had gained more nitrogen, phosphorus and potassium uptake in grain and total uptake in the pooled mean than rest of the varieties except total K uptake where medium duration Karjat-5 was significantly the highest. Whereas, in terms of N, P and K uptake in straw, medium duration Karjat-5 had accumulated significantly the highest value followed by the short duration hybrid Sahyadri-4.

Keywords: Sowing times, Varieties, Economics and Yield

Introduction
Rice (*Oryza sativa* L.) is one of the most important staple food grain crop of the world, which constitute the principle food for 60 per cent of the world's population and 2/3rd of Indian population. Rice is intensively grown in 88 countries across the world on an area about 160.01 million hectares with annual production of 465.48 million tonnes [1]. More than 90 per cent of the world's rice is produced and consumed in Asia where it is an integral part of culture and tradition. Rice, it is believed, is associated with wet, humid climate, though it is not a tropical plant. It is probably a descendent of wild grass that was most likely cultivated in the foothills of the far Eastern Himalayas.

Rice based agriculture is the largest source of livelihood of majority of rural mass in *Konkan*, which lies along the Arabian seacoast at the extreme western part of the Indian peninsula. Among the wet season crops in *Konkan*, rice alone occupies an area about 3.83 lakh hectares with production of 10.59 lakh tonnes and per hectare yield of 2.76 tonnes [2]. In *Konkan* region of Maharashtra about 80 per cent of rice crop is a low land, spreading over a 40-60 km in width and stretching to a length of 700 km all along the west-coast. But the yields are highly variable due to aberration in weather like late onset of monsoon, heavy continuous rains, intermittent dry spell and heavy rains at the time of harvesting, etc.

Time of sowing is the most important factor in influencing the crop yield. Performance of a genotype entirely depends upon the time of planting. Delay in planting generally results in yield reduction which cannot be compensated by any other means. Studies investigating the effect of seeding date on rice grain yields have been sporadically conducted since very past. Despite numerous studies on rice seeding dates conducted in India, the rate of yield loss from delayed seeding has never been quantified. Specific information on the rate of yield decline of modern rice cultivars to seeding date in rice producing areas of *Konkan* region is needed to assist rice producers in making crop management decisions.

Varieties play a unique role in maximizing yield by improving the input- use efficiency as the genetic potential of variety limits the expression of its yield and affects plant growth in response to environment condition. The reasons of low productivity of rice in rainfed lowland ecosystem are many and varied.

Lack of suitable varieties with stress tolerance at various stages of growth is one of the limiting factor. Under rainfed lowland conditions, crop has to experience varying depth of water of various stages of growth affecting adversely its performance. Of late, many promising varieties have been evolved for midland and lowland ecosystems, making it essential to investigate differential response of some promising varieties to rainfed lowland conditions.

Materials and Methods

The experiment was conducted during *Kharif* 2013 and 2014 at Agronomy farm, College of Agriculture, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Distt.- Ratnagiri Maharashtra. The experiment was laid out in split plot design with three replication. There were three main plot treatments consisting sowing times *viz*., 23rd meteorological week (4th June to 10th June), 24th meteorological week (11th June to 17th June) and 25th meteorological week (18th June to 24th June) and sub plot treatments consisting nine different duration varieties. *viz*., Karjat-5 (125-130 days), Karjat-7 (115-120 days), Ratnagiri-24 (105-110), Karjat-2 (135-140 days), Palghar-1 (125-130 days), Karjat-3 (110-115 days), Swarna (140-145 days), Sahyadri-4 (115-120 days) and Jaya (125-130 days). The soil was lateritic, clay loam in texture, medium in available nitrogen (306.21 kg ha^{-1}) and phosphorus (11.8 kg ka^{-1}), high in available potassium (271.89 kg ha^{-1}), very high in organic carbon (1.2 %) and slightly acidic in reaction (pH 6.1). The rice varieties were sown according to sowing times and transplanted at 21 DAS at spacing of 20 cm x 15 cm. In nutrient management, urea was applied as source of nitrogen, Single Super Phosphate (SSP) for phosphorus, while Murate of Postash (MOP) for potassium. All these treatments were imposed as per the schedule and statistical data of these variables obtained during the course of investigation were analyzed by analysis of variance method as per the procedure (Split plot design) described by [3 & 4].

Results and Discussion

Effect of Sowing times

Data insulate in Table 1 indicated that, sowing during 23rd meteorological week recorded significantly higher grain yield ha^{-1} as compared to 25th meteorological week and found statistically at par with sowing during 24th meteorological week sowing during both the years and pooled. The mean increase in grain yield due to sowing during 23rd meteorological week over sowing during 24th and 25th meteorological week was to the tune of 7.65 and 21.98 per cent, respectively (Pooled data). The increased yield might be due to result of optimum growth and development parameters and yield contributes associated with 23rd meteorological week of sowing followed by 24th meteorological week treatment, which associated with favourable weather condition responsible for more growth and development of crop. These results are in the conformity with the work done by [4 & 5]. However, higher straw yield was recorded by the sowing during 23rd meteorological week and was at par with the 24th meteorological week of sowing but both found to be significantly superior over the 25th meteorological week of sowing during both the years of study. Whereas in the pooled data, the sowing during 23rd meteorological week proved its significant superiority over remaining sowing times in terms of straw yield ha^{-1}.Magnitude of increase in mean straw yield under the 23rd meteorological week sowing over 24th and 25th meteorological week sowing was to the tune of 5.67 and 16.72 per cent, respectively (Pooled data). This might be due to increased morphological characters *viz*., plant height, number of leaves $hill^{-1}$, number of tillers $hill^{-1}$ and dry matter production $hill^{-1}$ associated in the 23rd meteorological week sowing. Similar findings were also reported by [5].

Table 1: Mean yield of grain (q ha^{-1}) and straw (q ha^{-1}) of rice as influenced by different treatments

Sym.	Treatments	Grain yield (q ha^{-1})			Straw yield (q ha^{-1})		
		2013	2014	Pooled mean	2013	2014	Pooled Mean
Sowing time							
S_1	23rd Met. Week (4th to 10th June)	50.22	52.22	51.22	57.86	56.90	57.38
S_2	24th Met. Week (11th to 17th June)	45.92	49.24	47.58	55.15	53.44	54.30
S_3	25th Met. Week (18th to 24th June)	40.19	43.79	41.99	49.71	48.62	49.16
	S.E.±	1.35	1.33	0.95	0.93	0.97	0.67
	C.D. at 5%	5.28	5.22	3.08	3.67	3.82	2.20
Varieties							
V_1	Karjat – 5	41.43	42.55	41.99	66.07	63.26	64.67
V_2	Karjat – 7	47.66	49.99	48.82	49.56	50.71	50.14
V_3	Ratnagiri – 24	39.19	37.16	38.17	47.66	45.03	46.34
V_4	Karjat – 2	46.55	48.84	47.70	55.37	52.76	54.06
V_5	Palghar – 1	43.45	44.73	44.11	51.83	47.01	49.42
V_6	Karjat – 3	44.45	46.87	45.66	50.29	49.10	49.69
V_7	Swarna	43.17	53.28	48.22	54.73	57.54	56.14
V_8	Sahyadri -4	52.55	56.72	54.64	57.26	57.11	57.18
V_9	Jaya	50.48	55.63	53.05	55.39	54.37	54.88
	S.E.±	0.73	0.78	0.53	1.23	0.95	0.77
	C.D. at 5%	2.07	2.22	1.48	3.49	2.71	2.16
Interaction Effect							
	S.E.±	1.26	1.35	1.30	2.124	1.65	1.88
	C.D. at 5%	N.S.	N.S.	3.64	N.S.	N.S.	5.29
General Mean		45.44	48.42	46.93	54.24	52.99	53.61

The foregone discussion suggests that second year environmental condition was much better for grain production than first year which was good for vegetative growth. Delay in sowing significantly reduced the grain yield and straw yield but it was more pronounced in second year. The production of above ground biomass a straw yield was more in first year and grain yield in second year. Maximum straw yield (57.86 q ha^{-1}) was obtained during first year. Whereas, highest grain yield (52.22 q ha^{-1}) was recorded in second year at early date of seeding. Similar results were reported by [7].

The sowing during 23rd and 24th meteorological week recorded almost identical and higher N, P and K content in grain and straw of rice than that of 25th meteorological week sowing during both the years of experimentation. While in the pooled mean, the sowing during 23rd meteorological week recorded significantly more N, P and K content in both grain and straw over remaining sowing times. This might be due to the fact that the early sowing of rice found to be more effective for N, P and K concentration and dry matter production as also reported by various workers [8 & 9].

The uptake of N, P and K recorded maximum with the crop sown during 23rd meteorological week followed by 24th and 25th meteorological week sowing in descending order during both the years of study and in the pooled data. Since, uptake is a function of grain and straw yield and their nutrient content, the significant improvement in the content of these nutrients coupled with increased grain and straw yield increased the uptake of nutrient substantially. These results corroborate with the findings of [10 &11].

Effect of Varieties

Data indicated in Table 1 showed that short duration hybrid Sahyari-4 was remunerative and produced significantly the highest grain yield than rest of the varieties and followed by medium duration Jaya within level of significance. The hybrid Sahydari-4 significantly out yielded all the varieties during both the years and in the pooled mean and produced the grain yield of 52.55, 56.72 and 54.64 q ha^{-1} respectively, which was higher than the other tested varieties. The mean increase in the grain yield of the short duration hybrid Sahyadri-4 over medium duration Jaya, short duration Karjat-7, long duration Swarna and Karjat-2, short duration Karjat-3, medium duration Palghar-1 and Karjat-5 and short duration Ratnagiri-24 was to the tune of 3.00, 11.92, 13.31, 14.55, 19.67, 23.87, 30.13 and 43.15 per cent, respectively. Hybrid Sahyadri-4 and conventional variety Jaya performed better due to more conversion of photosynthesis into economic produce, which resulted in higher yield contributing characters in the respective varieties. Similar results were reported by [12, 13 & 14]. They reported that the hybrid produced more yield than the conventional varieties. Perusal of data revealed that the response of all the varieties improved in the second year. It might be due to favorable environmental conditions during reproductive stages. Similar results were reported by [7].

Medium duration variety Karjat-5 produced significantly higher straw yield during both the years and in the pooled data to the tune of 66.07, 63.26 and 64.67 q ha^{-1} respectively, in comparison to the other tested varieties (Table 1). The increase in the mean straw yield under medium duration variety Karjat-5 over the short duration Sahyadri-4, late duration Swarna, medium duration Jaya, late duration Karjat-2, early duration Karjat-7 and Karjat-3, medium duration Palghar-1 and early duration Ratnagiri-24 was to the tune of 13.10, 15.19, 17.84, 19.63, 28.98, 30.15, 30.86 and 39.55 per cent, respectively. This was due to the increased morphological characters *viz*., plant height and dry matter production $hill^{-1}$observed in the Karjat-5. [14, 15 & 16] reported that the medium duration varieties produced more straw yield as compared to the short and long duration varieties.

From the foregoing salient results it is evident that the long duration variety Swarna and short duration hybrid Sahyadri-4 had statistically similar N, P and K concentration in their grains and both recorded significantly higher N, P and K concentration in their grains than rest of the varieties during both the years of the field study, except P and K content in grain, where the medium duration variety Jaya also remained at par with both of these former varieties during both the years of experimentation. However, in the pooled data, long duration variety Swarna had significantly the highest N, P and K concentration in its grain, which was significantly higher than rest of the varieties, except P and K content in grain, where short duration hybrid Sahyadri-4 also remained at par with the former variety, in addition to this another variety i.e. medium duration Jaya was also remained at par with both of the above varieties with respect to K content in grain. During both the years and in the pooled data, the highest N, P and K concentration in straw was estimated in the medium duration variety Karjat-5 which was at par with the short duration hybrid Sahdyari-4 and both the varieties were significantly superior than rest of the varieties, except Jaya where it was at par with both of the former varieties with respect to N concentration in straw during the year of 2014, P concentration in straw during both the years and in the pooled data and K concentration in the straw during both the years of study. In case of N, P and K uptake in grain and total uptake, the short duration hybrid Sahyadri-4 had gained more uptake than rest of the varieties except total K uptake; where medium duration Karjat-5 recorded significantly higher value. Whereas, in terms of N, P and K uptake in the straw, the medium duration Karjat-5 recorded significantly higher value than rest of the varieties except the short duration Sahyadri-4, which was at par with the former variety with respect to P uptake in the straw during the year of 2014. In fact, the significant variations in NPK concentrations in grain and straw and their respective grain and straw yields have caused a significant difference in N, P and K uptake by the different varieties. Varietal differences in nutrients uptake has been reported by many workers [11, 18 & 19] studied the N, P and K uptake of different rice cultivars. They reported that N, P and K uptake was significantly influenced by the cultivars.

Interaction effects

The interaction effects among the different sowing times and varieties for both grain and straw yield were found to be significant in the pooled mean of the data (Table 1.1 and 1.2). The short duration hybrid Sahyadri-4 sown during 23rd meteorological week recorded significantly higher grain yield as compared to rest of the treatment combinations except the same variety sown during 24th meteorological week and medium duration Jaya sown during 23rd meteorological week, which were at par with the former treatment combination. On the other hand, in case of straw yield, significantly higher values was recorded under the combination of medium duration variety Karjat-5 and 23rd meteorological week sowing and it remained at par with the same variety when sown during 24th meteorological week. Further, rest of the treatment combinations were significantly inferior as compared to the highest treatment combination i.e. variety Karjat-5 sown during 23rd meteorological week. Similarly [12, 20 & 21]. reported that the higher yield was produced due to the early sowing in the month of June by most of the varieties.

Table 1: Interaction effect of the sowing times and varieties on grain yield (q ha^{-1}) of rice in the pooled mean.

Sowing time	Varieties								
	V_1	**V_2**	**V_3**	**V_4**	**V_5**	**V_6**	**V_7**	**V_8**	**V_9**
S_1	47.04	52.65	41.84	49.37	49.36	49.63	54.39	59.28	57.43
S_2	42.18	51.28	39.68	47.85	43.70	45.06	46.42	57.52	54.54
S_3	36.75	42.54	33.00	45.87	39.26	42.30	43.86	47.12	47.20
MEAN	41.99	48.82	38.17	47.70	44.11	45.66	48.22	54.64	53.05
S.E.±	1.30								
C.D. at 5%	3.64								

Table 2: Interaction effect of the sowing times and varieties on straw yield (q ha^{-1}) of rice in the pooled mean

Sowing time	Varieties								
	V_1	**V_2**	**V_3**	**V_4**	**V_5**	**V_6**	**V_7**	**V_8**	**V_9**
S_1	69.87	57.46	48.12	55.87	52.96	53.34	63.53	59.41	55.87
S_2	67.09	49.28	47.80	54.16	51.01	50.49	54.90	57.41	55.52
S_3	57.04	43.67	43.10	52.16	44.30	45.25	49.98	54.72	53.25
MEAN	64.67	50.14	46.34	54.06	49.42	49.69	56.14	57.18	54.88
S.E.±	1.88								
C.D. at 5%	5.29								

Table 2: Nitrogen content (%) and nitrogen uptake (kg ha^{-1}) in grain, straw and total uptake of rice as influenced by the different treatments

Sym.	Sowing Dates	Nitrogen content (%)						Nitrogen uptake (kg ha^{-1})								
		Grain			Straw			Grain			Straw			Total		
		2013	**2014**	**mean**	**2013**	**2014**	**mean**	**2013**	**2014**	**Mean**	**2013**	**2014**	**mean**	**2013**	**2014**	**mean**
Sowing time																
S_1	23rd Met. week (4th to 10th June)	1.145	1.153	1.149	0.525	0.521	0.523	57.61	60.48	59.05	30.45	29.73	30.09	88.06	90.21	89.14
S_2	24th Met. Week (11th to 17th June)	1.123	1.133	1.130	0.506	0.504	0.505	51.80	54.88	53.34	28.03	27.12	27.57	79.82	81.99	80.91
S_3	25th Met. Week (18t^{h} to 24th June)	1.093	1.073	1.083	0.461	0.459	0.460	44.06	48.35	46.21	23.09	22.38	22.74	67.15	70.74	68.94
	S.E.±	0.005	0.008	0.005	0.006	0.009	0.005	1.71	1.84	1.26	0.76	1.08	0.66	2.43	0.87	1.77
	C.D. at 5%	0.021	0.032	0.016	0.023	0.034	0.017	6.70	7.23	4.10	2.97	4.22	2.14	9.53	10.10	5.77
Varieties																
V_1	Karjat – 5	1.098	1.096	1.097	0.535	0.529	0.532	45.54	46.85	46.19	35.39	33.58	34.49	80.93	80.43	80.68
V_2	Karjat – 7	1.088	1.088	1.088	0.474	0.480	0.477	52.00	54.51	53.26	23.59	24.52	24.06	75.59	79.03	77.31
V_3	Ratnagiri – 24	1.068	1.052	1.060	0.458	0.449	0.454	41.97	39.18	40.58	21.93	20.22	21.07	63.90	59.40	61.65
V_4	Karjat – 2	1.148	1.149	1.149	0.495	0.485	0.490	53.50	56.13	54.81	27.46	25.63	26.54	80.95	81.76	81.35
V_5	Palghar – 1	1.078	1.074	1.076	0.492	0.481	0.486	47.02	48.13	47.58	25.67	22.62	24.15	72.70	70.76	71.73
V_6	Karjat – 3	1.108	1.109	1.109	0.482	0.478	0.480	49.35	52.03	50.69	24.35	23.59	23.97	73.70	75.62	74.66
V_7	Swarna	1.181	1.186	1.183	0.504	0.511	0.508	51.07	63.39	57.23	27.69	29.47	28.58	78.76	92.86	85.81
V_8	Sahyadri -4	1.168	1.170	1.169	0.522	0.521	0.521	61.48	66.46	63.97	29.97	29.77	29.87	91.45	96.23	93.84
V_9	Jaya	1.155	1.157	1.156	0.515	0.520	0.518	58.46	64.45	61.46	28.65	28.29	28.47	87.11	92.74	89.92
	S.E.±	0.005	0.006	0.004	0.006	0.006	0.004	0.88	1.00	0.66	0.76	0.66	0.50	1.40	1.05	0.97
	C.D. at 5%	0.015	0.016	0.011	0.017	0.017	0.012	2.51	2.84	1.85	2.15	1.87	1.39	3.98	3.93	2.73
Interaction Effect																
	S.E.±	0.009	0.010	0.009	0.010	0.011	0.010	1.53	1.73	1.61	1.31	1.14	1.21	2.43	2.40	2.39
	C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General Mean		1.122	1.120	1.121	0.497	0.495	0.496	51.15	54.57	52.86	27.19	26.41	26.80	78.34	80.98	79.66

Table 3: Phosphorus content (%) and phosphorus uptake (kg ha^{-1}) in grain, straw and total uptake of rice as influenced by the different treatments

Sym.	Sowing Dates	Phosphorus content (%)						Phosphorus uptake (kg ha^{-1})								
		Grain			Straw			Grain			Straw			Total		
		2013	2014	mean	2013	2014	mean	2013	2014	mean	2013	2014	mean	2013	2014	Mean
Sowing time																
S_1	23rd Met. Week (4th to 10th June)	0.358	0.362	0.360	0.160	0.155	0.157	18.11	19.18	18.64	9.34	8.95	9.14	27.45	28.13	27.79
S_2	24th Met. Week (11th to 17th June)	0.345	0.350	0.347	0.150	0.145	0.147	15.95	17.11	16.53	8.44	7.94	8.19	24.39	25.05	24.72
S_3	25th Met. Week (18th to 24th June)	0.309	0.314	0.312	0.117	0.112	0.115	12.49	14.21	13.35	5.96	5.57	5.77	18.46	19.78	19.12
	S.E.±	0.005	0.003	0.003	0.003	0.003	0.002	0.65	0.59	0.44	0.31	0.32	0.16	0.88	0.93	0.60
	C.D. at 5%	0.018	0.013	0.009	0.014	0.014	0.008	2.57	2.32	1.44	1.20	1.25	0.52	3.44	3.66	1.95
Varieties																
V_1	Karjat – 5	0.326	0.331	0.329	0.180	0.176	0.178	13.56	14.13	13.84	12.27	10.96	11.61	25.83	25.08	25.46
V_2	Karjat – 7	0.319	0.326	0.322	0.110	0.115	0.113	15.20	16.29	15.74	5.51	5.94	5.72	20.71	22.22	21.47
V_3	Ratnagiri – 24	0.279	0.270	0.275	0.106	0.096	0.101	11.00	10.10	10.55	5.12	4.34	4.73	16.12	14.43	15.27
V_4	Karjat – 2	0.348	0.354	0.351	0.137	0.122	0.130	16.24	17.30	16.77	7.65	6.52	7.08	23.89	23.82	23.85
V_5	Palghar – 1	0.302	0.306	0.304	0.127	0.107	0.117	13.19	13.72	13.45	6.65	5.02	5.83	19.84	18.74	19.29
V_6	Karjat – 3	0.336	0.344	0.340	0.122	0.117	0.119	15.03	16.15	15.59	6.19	5.84	6.01	21.22	21.98	21.60
V_7	Swarna	0.384	0.388	0.386	0.149	0.164	0.156	16.67	20.82	18.75	8.30	9.50	8.90	24.96	30.32	27.64
V_8	Sahyadri -4	0.376	0.384	0.380	0.177	0.175	0.176	20.00	21.96	20.98	10.22	10.05	10.14	30.23	32.01	31.12
V_9	Jaya	0.366	0.376	0.371	0.167	0.169	0.168	18.77	21.02	19.90	9.31	9.22	9.27	28.08	30.25	29.16
	S.E.±	0.007	0.007	0.005	0.006	0.006	0.004	0.45	0.48	0.32	0.37	0.38	0.26	0.71	0.73	0.50
	C.D. at 5%	0.021	0.019	0.014	0.016	0.016	0.011	1.27	1.36	0.91	1.04	1.08	0.73	2.03	2.07	1.42
Interaction Effect																
	S.E.±	0.013	0.011	0.012	0.010	0.010	0.010	0.77	0.83	0.79	0.64	0.66	0.64	1.24	1.26	1.24
	C.D. at 5%	N.S.	N.S.	N.S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General Mean		0.337	0.342	0.340	0.142	0.137	0.140	15.52	16.83	16.17	7.91	7.49	7.70	23.43	24.32	23.87

Table 4: Potassium content (%) and potassium uptake (kg ha^{-1}) in grain, straw and total uptake of rice as influenced by the different treatments

Sym.	Sowing Dates	Potassium content (%)						Potassium uptake (kg ha^{-1})								
		Grain			Straw			Grain			Straw			Total		
		2013	2014	mean	2013	2014	mean	2013	2014	mean	2013	2014	mean	2013	2014	mean
Sowing time																
S1	23rd Met. Week (4th to 10th June)	0.463	0.470	0.467	1.233	1.229	1.231	23.38	24.81	24.10	71.77	70.45	71.11	95.16	95.27	95.21
S2	24th Met. Week (11th to 17th June)	0.446	0.455	0.451	1.191	1.187	1.189	20.58	22.12	21.35	66.20	64.20	65.20	86.78	86.33	86.55
S3	25th Met. Week (18th to 24th June)	0.402	0.411	0.406	1.065	1.061	1.063	16.24	18.61	17.43	53.64	52.16	52.90	69.89	70.77	70.33
	S.E.±	0.005	0.007	0.004	0.011	0.012	0.008	0.61	0.83	0.52	1.06	1.42	0.89	1.64	1.55	1.13
	C.D. at 5%	0.019	0.027	0.014	0.044	0.046	0.026	2.39	2.27	1.68	4.18	5.59	2.90	6.46	6.08	3.68
Varieties																
V1	Karjat – 5	0.424	0.428	0.426	1.343	1.331	1.337	17.61	18.33	17.97	88.85	84.51	86.68	106.45	102.86	104.65
V2	Karjat – 7	0.412	0.422	0.417	1.036	1.040	1.038	19.71	21.10	20.40	51.69	53.56	52.62	71.40	74.66	73.03
V3	Ratnagiri – 24	0.375	0.377	0.376	1.002	0.994	0.998	14.78	14.08	14.43	47.93	44.83	46.38	62.71	58.92	60.81
V4	Karjat – 2	0.444	0.452	0.448	1.138	1.126	1.132	20.74	22.09	21.41	63.13	59.55	61.34	83.87	81.65	82.76
V5	Palghar – 1	0.393	0.397	0.395	1.110	1.097	1.103	17.29	17.90	17.60	57.84	51.67	54.75	75.13	69.57	72.35
V6	Karjat – 3	0.437	0.445	0.441	1.066	1.062	1.064	19.48	20.92	20.20	54.05	52.78	53.41	73.52	73.69	73.61
V7	Swarna	0.492	0.504	0.498	1.208	1.220	1.214	21.26	26.92	24.09	66.67	70.52	68.60	87.93	97.44	92.68
V8	Sahyadri -4	0.484	0.494	0.489	1.302	1.300	1.301	25.60	28.17	26.89	74.67	74.38	74.53	100.28	102.55	101.41
V9	Jaya	0.475	0.487	0.481	1.264	1.262	1.263	24.16	27.14	25.65	70.02	68.62	69.32	94.18	95.76	94.97
	S.E.±	0.010	0.010	0.007	0.031	0.032	0.022	0.63	0.63	0.44	2.42	2.21	1.62	2.81	2.45	1.84
	C.D. at 5%	0.029	0.029	0.020	0.089	0.090	0.062	1.79	1.80	1.24	6.87	6.30	4.55	8.00	6.96	5.18
Interaction Effect																
	S.E.±	0.017	0.018	0.017	0.054	0.055	0.054	1.09	1.09	1.08	4.19	3.84	3.97	4.87	4.24	4.52
	C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General Mean		0.437	0.445	0.441	1.163	1.159	1.161	20.07	21.85	20.96	63.87	62.27	63.07	83.94	84.12	84.03

Conclusion

In *Konkan* region, rice crop be sown during 23rd meteorological week to obtain higher grain and straw yield and more NPK content and uptake. Similarly, rice hybrid Sahyadri-4 and variety Jaya be grown for obtaining higher grain and straw yield more NPK content and uptake. Thus, it can be concluded that *Kharif* rice in *Konkan* be sown during 23rd meteorological week with hybrid Sahyadri-4 or conventional variety Jaya, so as to obtained higher yield and NPK uptake.

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