Genotype X Environment interaction analysis of rice genotypes under Boro condition for yield contributing traits

Abstract

An experiment was conducted using 30 rice genotypes along with standard check (Gautam) in two different dates of sowing for two year to assess their stability in terms of plant height, spikelets per panicle and grain yield in diverse environments during Rabi 2021-22 and 2022-23. The investigation was undertaken at Pusa Farm of Dr. Rajendra Prasad Agricultural University, Pusa, Samastipur, Bihar under open field conditions in randomized block design with two replications. The results showed that the genotypes like RAU 140118115, RAU 14211532573, RAU 14153576951 and Rajendra Saraswati are considered as stable for plant height and spikelets per panicle while for grain yield RAU 1417211517, RAU 1415121743, RAU 141535769534, RAU 141642522, RAU 13972581254, RAU 14171117432, Rasi, Vandana, Boro-3, Rajendra Nilam and Rajendra Laxami was found suitable for average environment and encompasses fair stability and wide adaptation over different environment.

Keywords: rice genotypes, yield contributing traits, grain yield, irrigation

Introduction

Rice (*Oryza sativa* L.) is a vital crop that serves as a staple food for a significant proportion of the global population. However, its production faces numerous challenges, including the impact of abiotic stresses such as water scarcity and high salinity. These challenges are particularly pronounced during the Boro season, which refers to the winter period in regions characterized by subtropical or tropical monsoon climates. The Boro season is distinguished by a prolonged dry phase followed by waterlogging due to controlled water release from reservoirs or irrigation channels.

The term "boro rice" refers to a specific type of rice that is grown from November to May in low-lying places, taking advantage of the remaining water in the field, the soil's prolonged moisture retention time, and surface water stored in surrounding ditches. Dry season (DS) rice grown during October/November to May/June in the fallow areas after recession of rain or after the harvest of wet season rice or after rice-mustard/potato/vegetable crops, is popularly known as Boro rice in West Bengal and Dalua rice in Orissa. In Assam, Tripura and Manipur, it is classified as Boro and early Ahu depending on the time of cultivation. Early Ahu is of shorter duration and requires life-saving irrigation with minimum inputs of fertilisers and pesticides. Ahu rice is cultivated up to an elevation of 600 m above mean sea level. Cultivars of varying duration groups are grown by the farmers depending upon their cropping schedule, appropriate utilization of resources, socio-economic condition etc. Dry season rice is the only source of income generation where excess soil moisture does not permit any other crop to be grown successfully. Dry season rice yields are often higher due to availability of more solar radiation, less pest problems and better management practices. It has become the main-stay for food security in the flooded, flood-prone and cyclone-prone areas of Eastern India and Bangladesh.

Low temperatures are frequently experienced by rice plants during the Rabi/Boro season, which can affect seedling development and result in subpar stand formation. Due to the loss of immature seedlings, these detrimental impacts frequently results in poorer seed germination and inconsistent stand establishment. In the present investigation were attempted to identify the way for maximising productivity and characterize the suitability of popular genotypes of different duration groups for their adaptation to Boro ecology based on their performance, consistency, growth behaviour, stability and pest and disease reactions etc under different dates of seeding.

Materials and Methods

Study Site and Experimental Design

The field experiment was conducted during Boro seasons of 2021-22 and 2022-23 at Pusa Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. The latitude and longitude of the experiment location are 25.98^0N and 85.67^0E, respectively. The mean altitude is 52 m above mean sea level.

Treatment details

The research was carried out under open field (first year) (i) date of sowing 10th December 2021, transplanting 5^{th} February 2022 and (ii) date of sowing 25th December, 2021, transplanting 20^{th} February, 2022) in boro season2021-22 and in boro season 2022-23 under open field (Second year) (i) date of sowing 10th December, 2022, transplanting 5^{th} February, 2023 and (ii) date of sowing 25th December, 2022, transplanting 20^{th} February, 2023) at Pusa farm where four different environment conditions named E1, E2, E3 and, E4 respectively, were used for stability study. Thirty rice genotypes including Gautam as check were used for the trial. The experiment was laid out in Randomized Block Design with two replications and 20x15 cm spacing.

Table 1: List of genotypes

SL. no.	Genotypes	SI. no.	Genotypes
G1.	RAU 1417-2-1-1-5-1-7	G16.	RAU 1463-16
G2.	RAU 1415-12-1-7-4-3	G17.	RAU 1397-18-3-7-9-4-7
G3.	RAU 1415-35-76-9-5-3-4	G18.	Rajendra Bhagwati
G4.	RAU 1401-18-1-1	G19.	Rasi
G5.	RAU 1401-18-1-1-5	G20.	Vandana

G6.	RAU 1428-54-35-5-5	G21.	Boro-3
G7.	RAU 1421-12-1-7-4	G22.	RAU 722-14-20
G8.	RAU 1417-9-7-22-5-7-3	G23.	Rajendra Saraswati
G9.	RAU 1451-66-1-1-5-1	G24.	Sahbhagi
G10.	RAU 1416-4-2-5-2-2	G25.	Rajshree
G11.	RAU 1397-2-5-8-1-2-5-4	G26.	RAU 1397-15
G12.	RAU 1417-11-1-74-3-2	G27.	RAU 1415-9
G13.	RAU 1421-15-3-2-5-7-3	G28.	Gautam (Check)
G14.	RAU 1415-35-7-6-9-5-1	G29.	Rajendra Nilam
G15.	RAU 1428-43-2-5-4	G30.	Rajendra Laxami

Observations recorded

The observation was recorded on Plant height, spikelets per panicle and grain yield (g/plant). The plant height was recorded on five tagged plants in each genotype from each replication at the time of 50% flowering stage. The spikelets in each panicle were counted for five selected plants in each replication in all genotype of rice. The grain yield data were collected by using average of five plants from each plot harvested at maturity stage from 30 genotypes of rice. The average data was recorded as g/plant.

Statistical analysis

The stability model of Eberhart and Russell (1966) were followed for analysis of four environment data . It involves the estimation of three stability parameters like mean ($\bar{X}i$), regression coefficient (bi) and deviation from regression (S^2 di), which are defined by the following mathematical model

$Yij = \boldsymbol{\mu}i + \beta i\ Ij + \delta ij$ (I= 1, 2,……..t and j = 1,2……..S)

Where, Yij= Mean of i^{th} genotype in j^{th} environment

$\boldsymbol{\mu}$ i =Mean of all genotype over all environment

Bi = The regression coefficient of i^{th} genotype on the environmental index, which measures response of genotype to varying environment

δij= The environmental index which is defined as deviation of the mean of all the genotypes at a given environment from the overall mean.

The regression coefficients and the mean value for 30 rice genotypes were analyzed by R software (Metan package).

Results and Discussion

Plant height

The data on mean performance of thirty rice genotypes are depicted in Table 2. The plant height data were ranged from 73.98(RAU139715) to 116.26 (RAU 142112174). The early date of sowing in E1 and E3 were showed significance over the late sown E2 and E4. Likewise considerable variantion was also reported by Shinde and Patel (2014). For Plant height (cm), environment E1 (87.83) was most favourable, followed by E4 (87.95), E2 (88.34) and E3 (89.83). The stability parameters ($\bar{X}$, b_i , and S^2d_i) as proposed by Eberhart and Russell (1966) of the individual genotypes are illustrated in table 2. The genotypes except RAU 1415121743 (84.98), RAU 141535769534 (101.45), RAU 14011811 (111.24), RAU 1428543555 (91.41), RAU 1417112174 (116.26), Rajendra Bhagwati (88.74), Boro-3 (89.63), Rajendra Saraswati (108.94) Sahbhagi (108.14), Rajshree (92.81) and RAU14159 (107.74) mean were shows inferior performance to the population mean (88.48). The examined result shows that RAU 141535769534, RAU 142112174, RAU 141642522, RAU 14211532573 and Rajendra Saraswati showed significant values and are stable genotypes. Genotypes like RAU 141535769534, RAU 140118115, RAU 142112174, RAU 141642522, RAU 14211532573, RAU 14153576951, Boro-3 and Rajendra Saraswati showed significant values *i.e* stable in favourable environments. similar reports has been done by Santos *et al*., (2015). Manivannan *et al*., (2019) also reported stable genotypes in different environments.

Spikelets per panicle

The data on mean performance of thirty rice genotypes are depicted in table 3. The spikelets per panicle data ranged from 109.75 (RAU 14179722573) to 207.37 (RAU 13972581254). The early date of sowing in E1 and E3 were showed significance over the late sown E2 and E4. Likewise considerable variation was also reported by (Nayak *et al*. (2022), Sreedhar *et al*. (2011), Shinde and Patel (2014), Haradari *et al*. (2017) and contrast with kumar, D. *et al*., (2010), Swapna et al. (2014). For spikelets per panicle environment E2 (172.93) was most favourable, followed by E4 (169.63), E1 (168.56) and E3 (165.8). The stability parameters ($\bar{X}$, b_i , and S^2d_i) as proposed by Eberhart and Russell (1966) of the individual genotypes are illustrated in table 3. The genotypes RAU 1417211517 (190.37), RAU 1415121743 (174.12), RAU 141535769534 (183.37), RAU 14011811 (176.87), RAU 140118115 (199.75), RAU 142112174 (176.62), RAU 1451661151 (181.12), RAU 13972581254 (207.37), RAU 14211532573 (169.25), RAU 14153576951 (175.62), RAU 7221420 (206.12), Rajendra Bhagwati (200.12), RAU 139715 (177.00) and RAU 14159 (188.25) were shows superior performance to the population mean (169.23). The examined results shows that RAU 1417211517, RAU 140118115, RAU 14211532573, RAU 14153576951, RAU 13971837947, RAU 7221420, Rajendra Saraswati and RAU 139715 were significant values and are stable genotypes. Genotypes like RAU 140118115, RAU 141642522, RAU 13971837947, RAU 7221420, Rajendra Saraswati and RAU 139715 showed high significant values *i.e* highly stable in favourable environments. Mahapatra KC and Das S (1999), Banik *et al*., (2021) reported similar results.

Table 2: Mean performance and stability parameters for plant height (cm)

Plant height (cm)								
SL. No.	**Genotypes**	**E1**	**E2**	**E3**	**E4**	$\bar{X}$	b_i	S^2D_i
1.	RAU 1417 2 1 1 5 1 7	82.45	82.75	79.65	80.95	81.45	0.30 ns	-0.39 ns
2.	RAU 1415 12 1 7 4 3	82.85	83.95	86.05	87.05	84.98	1.57 ns	1.42 ns
3.	RAU 1415 35 76 9 5 3 4	112.50	108.75	92.70	91.85	101.45	-1.67*	-4.35 *
4.	RAU 1401 18 1 1	108.40	103.30	118.45	114.80	111.24	-1.60 ns	-3.70 ns
5.	RAU 1401 18 1 1 5	81.20	81.30	94.65	89.25	86.60	-0.74 ns	-6.04 *
6.	RAU 1428 54 35 5 5	85.35	78.70	101.40	100.20	91.41	-0.11 ns	-0.68 ns
7.	RAU 1421 12 1 7 4	109.55	114.2	119.60	121.70	116.26	-1.27*	-3.90*
8.	RAU 1417 9 7 22 5 7 3	96.60	98.45	81.10	74.35	87.63	0.27 ns	0.18 ns
9.	RAU 1451 66 1 1 5 1	78.35	75.85	88.20	88.95	82.84	1.18 ns	-0.14 ns
10.	RAU 1416 4 2 5 2 2	73.95	78.25	92.20	89.75	83.54	0.51*	-0.26*
11.	RAU 1397 2 5 8 1 2 5 4	76.85	76.80	76.05	75.90	76.40	1.55 ns	1.38 ns
12.	RAU 1417 11 1 74 3 2	76.25	80.05	92.45	91.25	85.00	-1.30 ns	-2.98 ns
13.	RAU 1421 15 3 2 5 7 3	73.25	78.70	79.00	82.95	78.48	-1.06 *	-3.41*
14.	RAU 1415 35 7 6 9 5 1	85.55	86.15	77.90	80.05	82.41	-1.25 ns	-6.75 *
15.	RAU 1428 43 2 5 4	88.55	86.20	81.65	80.60	84.25	-0.69 ns	-1.61 ns
16.	RAU 1463 16	102.90	102.25	75.50	71.50	88.04	-1.17 ns	-1.82 ns
17.	RAU 1397 18 3 7 9 4 7	83.60	85.00	81.55	80.95	82.78	0.30 ns	0.20 ns
18.	Rajendra Bhagwati	80.00	84.05	97.55	93.35	88.74	0.90 ns	-0.41 ns
19.	Rasi	82.10	79.70	72.40	66.50	75.18	0.51 ns	-0.20 ns
20.	Vandana	100.10	100.70	74.90	70.35	86.51	1.34 ns	1.16 ns
21.	Boro-3	95.50	99.45	83.20	80.35	89.63	-1.56 ns	-4.39 *
22.	RAU 722 14 20	76.20	79.15	92.45	86.85	83.66	-1.95 ns	-3.25 ns
23.	Rajendra Saraswati	100.25	100.65	116.55	118.30	108.94	-1.90 *	-7.30 *
24.	Sahbhagi	98.95	106.15	115.70	111.75	108.14	-1.06 ns	-2.04 ns
25.	Rajshree	87.45	80.45	103.35	100.00	92.81	-0.66 ns	-1.21 ns
26.	RAU 1397 15	78.85	82.60	69.80	64.65	73.98	0.30 ns	0.20 ns
27.	RAU 1415 9	111.25	108.80	108.15	102.75	107.74	0.35 ns	-0.49 ns
28.	Gautam	75.75	78.90	81.85	83.35	79.96	0.43 ns	-0.38 ns
29.	Rajendra Nilam	75.60	73.55	86.00	87.15	80.58	1.59 ns	1.45 ns
30.	Rajendra Laxami	74.75	75.50	74.90	71.10	74.06	-1.52 ns	-3.83 ns
	Environmental Mean	87.83	88.34	89.83	87.95	88.48		
	C.D (5%)	8.96	10.35	7.81	7.69			

Table 3 : Mean performance and stability parameters for spikelets per panicle.

Spikelets per panicle								
SL. No.	**Genotypes**	**E1**	**E2**	**E3**	**E4**	$\bar{X}$	b_i	S^2D_i
1.	RAU 1417 2 1 1 5 1 7	189.50	194.50	188.00	189.50	190.37	1.70 *	0.25 ns
2.	RAU 1415 12 1 7 4 3	175.00	172.00	174.00	175.50	174.12	1.58 ns	0.80 ns
3.	RAU 1415 35 76 9 5 3 4	191.00	179.50	187.00	176.00	183.37	0.08 ns	-0.09 ns
4.	RAU 1401 18 1 1	191.50	160.00	186.00	170.00	176.87	0.42 ns	0.16 ns
5.	RAU 1401 18 1 1 5	198.50	214.00	187.00	199.50	199.75	1.05 *	0.55 *
6.	RAU 1428 54 35 5 5	146.50	154.00	146.00	158.50	151.25	1.37 ns	0.55 ns
7.	RAU 1421 12 1 7 4	182.00	172.50	179.50	172.50	176.62	0.99 ns	0.28 ns
8.	RAU 1417 9 7 22 5 7 3	112.50	110.50	109.50	106.50	109.75	-0.32 ns	-0.83 ns
9.	RAU 1451 66 1 1 5 1	181.50	183.50	182.00	177.50	181.12	-1.20 ns	-1.42 ns
10.	RAU 1416 4 2 5 2 2	129.00	121.00	130.50	132.50	128.25	1.61 ns	0.33 *
11.	RAU 1397 2 5 8 1 2 5 4	209.50	208.50	201.50	210.00	207.37	1.90 ns	1.88 ns
12.	RAU 1417 11 1 74 3 2	121.00	124.50	115.00	121.50	120.5	-0.24 ns	-0.36 ns
13.	RAU 1421 15 3 2 5 7 3	156.50	193.50	164.50	162.50	169.25	1.16 *	0.42 ns
14.	RAU 1415 35 7 6 9 5 1	144.00	210.50	149.50	198.50	175.62	1.65 *	0.30 ns
15.	RAU 1428 43 2 5 4	118.00	106.50	111.50	109.00	111.25	1.24 ns	0.13 ns
16.	RAU 1463 16	167.00	150.50	166.50	162.50	161.62	1.09 ns	0.26 ns
17.	RAU 1397 18 3 7 9 4 7	137.00	167.00	133.50	159.50	149.25	0.16 *	-0.31*
18.	Rajendra Bhagwati	194.00	211.50	195.50	199.50	200.12	-1.19 ns	-1.35 ns
19.	Rasi	172.00	198.00	172.50	178.50	180.25	1.57 ns	2.14 ns
20.	Vandana	184.00	208.00	159.50	197.50	187.25	1.35 ns	0.42 ns
21.	Boro-3	179.00	153.00	170.00	138.00	160.00	0.05 ns	-0.14 ns
22.	RAU 722 14 20	221.00	213.50	200.00	190.00	206.12	1.33 *	2.19 ns
23.	Rajendra Saraswati	164.00	153.00	161.50	177.00	163.87	1.97 *	1.89 ns
24.	Sahbhagi	198.00	192.50	190.50	170.50	187.87	1.22 ns	0.44 ns
25.	Rajshree	164.50	161.00	154.00	158.50	159.50	1.03 ns	0.24 ns
26.	RAU 1397 15	174.00	185.00	169.50	179.50	177.00	0.41*	-0.05 *
27.	RAU 1415 9	191.00	190.50	178.50	193.00	188.25	-0.97 ns	-1.23 ns
28.	Gautam	136.50	153.00	154.00	163.50	151.75	1.55 ns	0.12 ns
29.	Rajendra Nilam	115.50	141.00	143.50	142.00	135.05	0.78 ns	0.11 ns
30.	Rajendra Laxami	191.50	180.50	178.50	193.00	189.50	0.21 ns	0.02 ns
	Environmental Mean	168.56	172.93	165.80	169.63	169.23		
	C.D (5%)	39.38	39.58	26.77	22.67			

Table 4:Mean performance and stability parameters for grain yield (g/plant)

Grain yield (g/plant)								
SL. No.	**Genotypes**	**E1**	**E2**	**E3**	**E4**	$\bar{X}$	b_i	S^2D_i
1.	RAU 1417 2 1 1 5 1 7	40.55	44.17	42.03	43.04	42.45	0.04 ns	-9.06 *
2.	RAU 1415 12 1 7 4 3	59.76	56.74	52.04	52.46	55.25	-1.12 ns	-7.59 *
3.	RAU 1415 35 76 9 5 3 4	54.29	51.15	51.18	50.02	51.66	-1.05 ns	-10.23 **
4.	RAU 1401 18 1 1	60.08	63.07	60.02	57.82	60.25	0.44 ns	-0.54 ns
5.	RAU 1401 18 1 1 5	67.13	67.19	61.07	64.42	64.95	-0.08 ns	-0.96 ns
6.	RAU 1428 54 35 5 5	61.20	62.04	57.88	62.11	60.81	0.67 ns	0.50 ns
7.	RAU 1421 12 1 7 4	64.27	63.83	63.26	66.00	64.34	1.43 ns	0.00 ns
8.	RAU 1417 9 7 22 5 7 3	40.95	42.05	41.04	46.17	42.55	1.05 ns	-0.35 ns
9.	RAU 1451 66 1 1 5 1	59.07	61.75	59.49	57.37	59.42	1.13 ns	0.86 ns
10.	RAU 1416 4 2 5 2 2	51.50	52.70	51.87	50.25	51.58	-0.70 ns	-7.70 *
11.	RAU 1397 2 5 8 1 2 5 4	59.53	64.84	52.98	55.03	58.09	-1.03 ns	-7.13 *
12.	RAU 1417 11 1 74 3 2	69.38	71.23	61.96	66.66	67.30	-1.33 *	-10.55 **
13.	RAU 1421 15 3 2 5 7 3	40.94	42.64	45.12	43.98	43.17	0.68 ns	-0.03 ns
14.	RAU 1415 35 7 6 9 5 1	48.29	48.69	50.01	48.84	48.95	0.16 ns	-0.75 ns
15.	RAU 1428 43 2 5 4	57.55	60.31	58.98	60.18	59.25	0.59 ns	0.32 ns
16.	RAU 1463 16	64.43	59.43	58.32	56.13	59.58	1.06 ns	-0.72 ns
17.	RAU 1397 18 3 7 9 4 7	42.23	43.39	41.85	45.34	43.20	0.91 ns	-0.50 ns
18.	Rajendra Bhagwati	61.81	60.98	59.51	60.62	60.73	1.20 ns	1.07 ns
19.	Rasi	51.45	50.64	50.94	51.09	51.03	0.56 ns	-5.26 *
20.	Vandana	67.11	69.11	64.12	67.42	66.94	-1.76 ns	-6.26 *
21.	Boro-3	62.03	60.14	57.82	57.36	59.34	-1.91 **	-8.46 **
22.	RAU 722 14 20	56.62	62.91	57.05	63.39	59.99	0.50 ns	-0.36 ns
23.	Rajendra Saraswati	71.11	71.77	67.70	71.81	70.60	-0.27 ns	-1.31 ns
24.	Sahbhagi	52.12	52.20	56.51	54.65	53.87	0.67 ns	0.48 ns
25.	Rajshree	46.50	49.93	45.13	48.66	47.55	1.66 ns	0.44 ns
26.	RAU 1397 15	42.61	43.44	42.59	44.99	43.41	0.89 ns	-0.28 ns
27.	RAU 1415 9	41.49	42.71	42.60	42.53	42.33	1.22 ns	0.97 ns
28.	Gautam	48.98	51.04	53.76	55.47	52.31	0.42 ns	-4.11 ns
29.	Rajendra Nilam	47.79	51.21	48.93	51.75	49.92	-1.92 ns	-5.75 *
30.	Rajendra Laxami	42.56	43.48	47.11	45.01	44.54	-1.43 *	-19.33 **
	Environmental Mean	54.11	55.16	52.96	54.25	54.12		
	C.D (5%)	5.46	5.81	5.40	5.54			

E1-Environment 1 date of sowing-10th Dec 2021, transplanting-5th Feb 2022, E2- Environment 2 date of sowing-25th Dec 2021, transplanting-20th Feb 2022, E3- Environment 3 date of sowing-10th Dec 2022, transplanting-5th Feb 2023, E4- Environment 4 date of sowing-25th Dec 2022, transplanting-20th Feb 2023, $\bar{X}$=Mean value, b_i =Regression coefficient, S^2D_i = deviation from regression, *= significant at 5% level,**= significant at 0.01% level, C.D= Critical difference.

Grain yield

The data on mean performance of thirty rice genotypes are depicted in table 4. The grain yield data were ranged from 42.33 (RAU 14159) to 70.60 (Rajendra Sarawati). The early date of sowing in E1 and E3 were showed significance over the late sown E2 and E4. Likewise considerable variantion was also reported by (Nayak *et al.*, 2022). For grain yield (gm/plant), environment E2 (55.16) was most favourable, followed by E4 (54.25), E1 (54.11) and E3 (52.96). The stability parameters ($\overline{X}$, b_i , and S^2d_i) as proposed by Eberhart and Russell (1966) of the individual genotypes are illustrated in table 4. The genotypes viz., RAU 1415121743 (55.25), RAU 14011811 (60.25), RAU 140118115 (64.95), RAU 1428543555 (60.81), RAU 142112174 (64.34), RAU 1451661151 (59.42), RAU 13972581254 (58.09), RAU 14171117432 (67.30), RAU 142843254 (59.25), RAU 146316 (59.58), Rajendra Bhagwati (60.73), Vandana (66.94), Boro-3 (59.34), RAU 7221420 (59.99) and Rajendra Saraswati (70.60) mean were shows superior performance to the population mean (54.12). The examined result shows that RAU 14171117432, Boro-3 and Rajendra Laxami were negative and significant. Genotypes like RAU 1417211517, RAU 1415121743, RAU 141535769534, RAU 141642522, RAU 13972581254, RAU 14171117432, Rasi, Vandana, Boro-3, Rajendra Nilam and Rajendra Laxami showed high significant values *i.e* highly stable in favourable environments. (Nayak, *et al*., 2022, Sreedhar *et al*. (2011), Shinde and Patel (2014), Swapna *et al*. (2014), Reddy *et al*. (2015), Pande *et al*. (2006), Manjunatha *et al*. (2018), Al-kordy *et al*. (2019) and Patel *et al*. (2019).

Conclusion

Genotypes which have regression coefficient (bi =1), trait mean more than population mean ($\bar{x}>\mu$), small deviation from regression (S^2di) are considered as stable which are RAU 140118115, RAU 14211532573, RAU 14153576951 and Rajendra Saraswati for plant height and spikelets per panicle while for grain yield RAU 1417211517, RAU 1415121743, RAU 141535769534, RAU 141642522, RAU 13972581254, RAU 14171117432, Rasi, Vandana, Boro-3, Rajendra Nilam and Rajendra Laxami was found suitable for average environment and encompasses fair stability and wide adaptation over different environment.

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