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Per-se Performance of Buckwheat (*Fagopyrum esculentum L.)* Genotypes for Plant Growth, Yield and Seed Quality Parameters in Prayagraj Agro-climatic Conditions

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Buckwheat is one of the most important alternative food crops it being a rich sources of protein and high nutritious value. The field experiment was conducted during rabi season in the year 2019-2020 at Department of Genetics and Plant Breeding Research farm, Naini Agriculture Institute, Prayagraj. With an objective to evaluate and identify suitable genotypes in Praygraj Agro-climatic conditions based on different quantitative and seed quality parameters. The field experiment conducted using randomized block design in field with 3 replications and complete randomized design in laboratory experiment with 4 replications. The results showed that among the 13 genotypes, EC-2018742 found to be promising genotype with 23.55 seeds infloresence^{-1} 481.71 seed plant^{-1} and 725.55 g seed yield plot^{-1} maximum yield recorded of 17.64 q/ha, genotype EC-

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2018742 found to be vigorous among the 13 genotypes with high seed vigour indices were found suitable for cultivation in Prayagraj region.

Keywords: Buckwheat; genotype; alternative crop; quality parameter; seed vigour.

1. INTRODUCTION

Buckwheat (Fagoporium esculentum Moench.) is a family of Polygonaceae. For more than one hundred decades the crop is mainly cultivated as grain crop, at high altitude regions such as Himalayan planes which are also a richest hotspot of biodiversity, buckwheat grows as the main food in hill areas that do not cultivate cereals and pulses. Although mankind has used more than 10,000 edible species, 150 species around the world are considerably traded, and 12 species are only the main nutrient requirements (80% of food power) and 60% protein and calorie requirements are cited by just four species: rice, wheat, maize and potato [1]. Worldwide buckwheat production is 1.673 M tonnes [2]. Buckwheat is gluten free with 11.2% protein, 2.4% fat, 10.7% fibre and minerals such as Cu, Fe, Zn. Buckwheat is short day plant that performs well in temperate regions and its productivity depends on sunshine hours, rainfall, site of cultivation and altitude 25-28 ^{0}C (required for germination) [3]. Buckwheat is mainly grown as a kharif season crop in the north Eastern states, However, Prayagraj has a subtropical climate in the agricultural climate zone. In winter, especially in December and January, the temperature drops to 2-3 ^{0}C, while during summer, it reaches up to 40-46 ^{0}C during winter, frost and during summer so high temperature adversely affect the crop, hence the buckwheat crop is sown as rabi season crop, The main objective of this study is to evaluate the suitable buckwheat genotype for growth, seed yield and its attributes in Prayagraj region.

2. MATERIALS AND METHODS

The study was conducted during rabi season 2019-2020 in the Field Test Centre and Seed Test Laboratory of the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj. Located at latitude 25.35^{0}N and longitude 82.25^{0}E at an altitude of 78 m above mean sea level, the soil is sandy loam in texture with moderate water holding capacity having pH of 7.0 to 8.0. Field experiment was laid down using randomized block design in three replications by using of 13 buckwheat genotypes sown at 15 X 10 cm row-to-row and plant-to-plant distance. Observations were recorded for each genotype on five randomly selected plants in each replication on characters viz., growth parameters field emergency, days to 50% flowering, days to maturity, plant height at maturity (cm), number of primary branches, Yield parameters are number of seeds per cluster, 1000 seed weight (g), seed yield per plant (g), and seed yield per plot (g). Laboratory experiment was conducted using Completely Randomized Design in four replications counted 100 seeds of each genotype were placed for germination. Seedling quality parameters were determined according to the standard procedures, i.e. between paper methods in germination cabinets with the application of standard temperature T-20 $\pm$10 ^{0}C for 7 and with 95% relative humidity ISTA [4]. Data was recorded on quality parameter i.e. germination %, seedling length (cm), dry weight (g), vigour index I, vigour index II. Field experiment mean data analysis of variance was being carried out according to the procedure of Randomized Block Design (RBD) for each character as Panse and Sukhatme [5]. Lab experiment data analysis of variance was be carried out according to procedure of Complete Randomized Design [6].

3. REASULTS AND DISCUSIONS

The analysis of variance among genotypes showed significant difference for all characters Table 1 indicates.

3.1 Growth Attributes

Field emergence was found to be significant and was recorded highest in the genotype Ogla Local (76.13%) lowest field emergence was found Meethay (69.4%). Plant height found to be significant and recorded highest in the genotype Teethay (91.05 cm). Minimum plant height was recorded by the genotype IC-16551 (52.92 cm). Number of primary branches plant^{-1} recorded found to be significant genotype EC-2018742 (7.86) recorded maximum. The genotype IC-18881 recorded the minimum of (4.23) primary branches plant^{-1} respectively.

Table 1. Mean performance of plant growth and yield parameters of buckwheat

S. No	Genotype Code	Genotype	Field Emergence %	Days to 50% flowering	Days to Maturity	Plant Height(cm)	No. of Primary branches	No. of inflorescence plant^{-1}	Inflorescence length (cm)	No.of Seeds Inflorescence^{-1}	No. of Seeds plant^{-1}	1000 Seed Weight(g)	Seed Yield plant^{-1} (g)	Seed Yield per Plot^{-1} (g)	Seed Yield q/ha
1.	G1	Meethay	69.4	35.67	78.72	72.59	5.02	11.84	3.93	12.47	144.88	21.63	3.09	244.66	6.14
.	G2	IC-16559	72.6	39.06	80.13	90.93	6.74	21.75	4.49	13.76	290.63	21.9	6.35	531.15	13.21
.	G3	Teethay	74.87	41	92.31	91.05	6.99	18.82	3.08	14.85	276.21	18.5	5.15	435.49	10.9
.	G4	EC-2018742	71.4	38.3	92.44	82.27	7.86	21.34	7.43	23.55	481.71	24.44	8.89	725.55	17.64
.	G5	IC-13144	72.63	41.33	94	77.4	6.71	23.15	4.77	14.69	341.68	18.99	7.78	652.57	16.38
.	G6	IC-13412	75.13	41.29	85.33	66.16	6.66	23.85	3.48	11.71	283.13	15.72	4.34	372.33	9.32
.	G7	IC-13413	75.93	39.66	84.67	56.63	6.36	27.18	2.72	8.26	230.81	18.32	4.12	356.11	8.7
.	G8	IC-16551	73.67	40.27	76.93	52.92	7.35	26.62	2.31	7.56	201.76	15.41	3.09	256.69	6.35
.	G9	IC-16553	74.53	40	102.08	69.33	6.37	27.97	1.72	5.5	155.36	17.36	2.7	228.55	5.61
0.	G10	Ogla Local	76.13	41.72	77.99	72.27	7.69	11.06	6.11	19.35	210.78	18.41	3.88	324.34	8.19
1.	G11	IC-18881	70.6	27.15	75.03	67.25	4.23	22.49	2.11	6.63	146.56	23.03	3.52	287.37	7.19
2.	G12	IC-22426	73.06	41.79	87.66	61.07	7.41	21.21	4.2	13	281.38	20.35	5.58	473.22	11.79
3.	G13	IC-24297	74.06	40	87.33	70.2	7.42	26.68	2.65	8.27	211.75	21.33	4.45	375.95	9.49
4.	G Mean		73.38	39.001	85.74	71.54	6.67	21.84	3.77	12.2	250.51	19.64	4.84	404.92	10.07
5.	SE. m		0.58	0.59	1.68	1.28	0.14	0.43	0.08	0.32	5.42	0.44	0.1	5.09	0.24
6.	CV		1.39	2.62	3.39	3.11	3.79	3.42	3.95	4.62	3.74	3.96	3.72	3.46	4.22
7.	C.D at 5%		1.72	1.72	4.9	3.75	0.42	1.25	0.25	0.95	15.82	1.31	0.3	23.63	0.17

Table 2. Mean performance of seed quality parameters of buckwheat

S. No.	Genotype Code	Genotype	Germination %	Root length (cm)	Shoot Length (cm)	Seedling length (cm)	Fresh weight (g)	Dry weight (g)	Vigour Index I	Vigour Index II
1.	G1	Meethay	91.75	13.47	10.85	25.4	1.52	0.075	2330.46	6.87
2.	G2	IC-16559	89.75	12.21	10.06	22.61	1.27	0.063	2029.96	5.61
3.	G3	Teethay	88	12.95	10.75	23.67	1.22	0.083	2082.67	7.25
4.	G4	EC-2018742	93.5	16.73	11.06	27.3	2.10	0.088	2551.55	7.2
5.	G5	IC-13144	83	12.21	11.33	21.87	1.42	0.088	1816.08	8.81
6.	G6	IC-13412	87.5	12.11	10.23	22.32	1.07	0.073	1953.12	6.34
7.	G7	IC-13413	86.5	12.52	9.12	21.75	1.20	0.070	1882.76	6.05
8.	G8	IC-16551	93.75	12.58	9.38	22.73	1.07	0.083	2130.81	7.73
9.	G9	IC-16553	94	13.45	10.4	24.1	1.35	0.078	2264.77	7.28
10.	G10	Ogla Local	93.5	11.16	10.47	22.73	1.07	0.083	2128.93	7.72
11.	G11	IC-18881	92	13.17	13.46	26.63	1.25	0.080	2451.31	7.36
12.	G12	IC-22426	88.5	10.67	8.47	19.07	1.07	0.078	1690.37	6.83
13.	G13	IC-24297	92.25	15.21	10.37	25.33	1.22	0.063	2334.41	5.76
14.	G Mean		90.3	12.95	10.46	23.5	1.294	0.077	2126.71	6.98
15.	SE. m		3.06	10.17	5.82	20.09	0.081	0.003	259136.9	0.307
16.	CV		1.38	6.69	8.54	7.54	12.504	8.456	8.35	8.83
17.	C.D at 5%		1.71	1.24	1.27	2.53	0.23	0.09	254.1	0.88

3.2 Reproductive Attributes

Among the 13 genotypes considered, the days taken for 50% flowering was found to be significant and the minimum days for 50% flowering was recorded by the genotype IC-18881 (27.15 days) and the maximum was recorded in the genotype Ogla Local (41.72 days). The genotype IC-18881 took a minimum of (75.03 days) among all the genotypes to attain maturity while the genotype took maximum days to get maturity IC-16553 (102.08 days).

3.3 Yield Attributes

The genotype Ogla Local took a minimum of (11.06) among all the genotypes to attain number of inflorescence plant^{-1} while the genotype took maximum number of inflorescence plant^{-1} IC-16553 (27.97). However, Maximum number of seeds inflorescence^{-1} was recorded by the genotype EC-2018742 (23.55) the minimum number of seeds inflorescence^{-1} was recorded in IC-16553 (5.5). Maximum the number of seeds inflorescence^{-1} recorded by the genotype EC-2018742 (23.55) which was at par with Ogla Local (19.35). The minimum number of seeds inflorescence^{-1} recorded in IC-16553 (5.5). The maximum number of seeds plant^{-1} recorded by the genotype EC-2018742 (481.71). However, minimum number of seeds plant^{-1} recorded in Meethay (144.88). Maximum seed yield plant^{-1}, seed yield plot^{-1}, seed yield hectare^{-1} was recorded by the genotype EC-2018742. The minimum seed yield plant^{-1}, seed yield plot^{-1}, seed yield hectare^{-1} was recorded in IC-16553.

3.4 Seed Quality Parameters

Table 2 indicates Germination % was found to be highest in the genotype IC-16553 (94%) among all the genotypes and the lowest was recorded in the genotype IC-13144 (83 %). Total seedling length varied significantly among the genotypes and the maximum was recorded in the genotype EC-2018742 (27.3 cm) while the minimum was found in the genotype IC-22426 (19.07 cm). Maximum dry weight was recorded in the genotype EC-2018742, IC-13144 (0.088 g). While minimum was recorded in the genotype IC-16559, IC24297 (0.063g), genotype EC-2018742 found to be vigorous among the 13 genotypes with high seed vigour indices were found suitable for cultivation in Prayagraj region.

3.5 Discussion

Genotype IC-18881 record superior in growth, reproductive attributes but genotype fail at the stage of reproductive phase as a resulted low in yield attributes. Plant height of genotype Meethay was 72.5 cm similar result was observed by Maruti et al., [7]. In the genotype IC-13413 number of seed per inflorescence (8.26), IC-16553 Seed yield (5.6 q/ha), no. of primary branches (6.37) was obtained. These findings are similar to the earlier research work of Hulihalli et al., [8]. Seed yield of IC-16551 (6.35 q/ha) and Ogla local 8.19 q/ha, number of inflorescence per plant (11.06) these results are in the line with the results of Maruti et al., [7]. Days to maturity of Meethay is (78.72), plant height of IC-16559 (90.93cm), Teethay (91.05cm), IC-13413(56.63cm) was recorded similar to the observations by Joshi [9]. Maximum seed vigour index- I of EC-2018742 is (2551.55) found with the genotype . The finding was similar to the earlier research work of Aliyas et al., [10]. The vigour index-II of 7.72 was recorded with Ogla local; similar to the findings Bhaduri et al., [11].

4. CONCLUSION

The overall performance of buckwheat genotypes under study judged on the basis of positive results obtained indicated that, genotype EC-2018742 had shown superior performance with respect to growth, yield under agro-climatic conditions of Prayagraj region, found to be vigorous among the 13 genotypes with high seed vigour indices. Similarly, the genotype IC-13144 performance of at par. Hence, the genotypes EC-2018742 and IC-13144 of buckwheat can be suggested for commercial cultivation in Prayagraj agro climatic conditions.

FURTHER RESEARCH

The further investigation needs to conduct for the confirmation of the promising genotypes for Prayagraj region. The genotypes EC-2018742 and IC-13144 were found most promising for commercial cultivation under agro-climatic conditions of Prayagraj region and hence it can be useful for further crop improvement programme.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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