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RESEARCH **P**APER

Physiological study of Indian wheat varieties (*Triticum aestivum* L.)

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Twenty wheat varieties were evaluated for physiological study. The data showed that the highest germination percentage, seed moisture, seedling length, seed weight and seedling weight were in HW-2045 (98.92±1.08%), WH-711 (14.03±0.55%), HD-2894 (16.80±0.35cm), LOK-1 (5.11±0.07g/100seeds) and DBW-17 (17.67±0.33mg) and the lowest in HD-2894 (80.00±5.77%), HUW-234 (10.03±1.08%), PBW-154 (10.13±0.03cm), K-7903 (3.34±0.09g/100seeds) and PBW-226 (8.00±0.58mg).

Key words : Wheat, Germination percentage, Seed moisture, Seedling length, Seed weight

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INTRODUCTION

Wheat is one of the most important cereals crop in the world, together with rice and maize providing more than 60 per cent of the calories and proteins for human nutrition (Gill *et al*., 2004). The most promising approach to increase agricultural productivity and to satisfy human needs in the future is the genetic improvement of crops, which requires a continuous allocation of news ounces of genetic variation (Borner *et al*., 2000). Hexaploid wheat has no hexaploid wild relatives, but synthetic hexaploid wheat is considered a promising source of exotic alleles for introgression into wheat (Colmer *et al*., 2006). In India, cultivated area under wheat represents hexaploid spring type belonging to *Triticum aestivum* L. (Singh *et al.*, 2008). Developing seeds represent a major sink for plant phosphorus. Seeds typically accumulate several-fold more phosphorus than is needed to support basic cellular functions (Raboy, 1997). Breakfast cereal is defined as food obtained by soaking, swelling, heating, toasting, grinding, rolling or flaking and shredding of puffing of any cereal and which is usually eaten in breakfast. Flaking is one of the methods of processing breakfast cereal, which involves cleaning and conditioning to suitable moisture content of the whole grain and lightly rolled between smooth rolls to fracture the outer layer (Kent, 1975).

RESEARCH METHODOLOGY

Wheat varieties collection :

Twenty locally available wheat varieties evaluated include: DBW-17, WH-1021, HD-2894, PBW-502, PBW-226, RAJ-3765, HUW-234, PBW-154, K-9107, K-7903, WR-544, LOK-

1, PBW-373, PBW-550, WH-711, SONALIKA, WH-1025, RAJ-3777, KUNDAN and HW-2045. Prior to the experiments, seeds were surface sterilized with 5 per cent sodium hypochloride solution for five minutes followed by rinsing with double distilled water before use in the laboratory for physiological parameters study (Khan *et al*., 2003).

Germination percentage :

Seed germination percentage was checked in three replicates of ten seeds. The seeds were incubated in 9 cm Petri dishes on Whatman number 1 filter paper and the moisture requirement was checked daily. The germination of seeds was recorded as percentage.

Moisture content :

Ten seeds of all the varieties were kept in oven at high constant temperature of 130°C for 1h, The difference in weight of seeds was checked before and after heating, and seed moisture content was calculated as percentage.

Seedling length :

The length of 7 days old seedlings was measured from the base of the primary leaf to the base of the hypocotyl and the mean values of seedling length were expressed in centimetre.

Seed weight :

To calculate seed weight, three replicates of hundred seeds of each variety were weighed accurately. Seed weight is expressed in g /100 seeds.

Seedling fresh weight :

For seedling fresh weight (mg), 7 days old seedlings were wiped with filter paper for removal of excess water and the weight was recorded in three replicates.

Statistical analysis :

The data were analyzed by two-way ANOVA using SPSS software. The F-test at 5 per cent level of significance, mean values and standard error of the mean (SEM), critical difference (CD), co-efficient of variation (CV%), were reported for physiological study.

RESEARCH FINDINGS AND ANALYSIS

The observations on different physiological parameters *i.e.* seed germination, seed moisture, seedling length, seed weight and seedling fresh weight of all twenty wheat varieties were recorded.

Germination percentage :

The germination percentage of wheat varieties are depicted in Table 1. Among all varieties, maximum germination percentage was reported in HW-2045 (98.92±1.08%) followed by DBW-17 (96.67±3.33), WH-1021(96.73±3.26), PBW-502 (86.67±3.33), PBW-226 (96.67±3.33), RAJ-3765 (96.67±3.33), HUW-234 (83.33±3.33), PBW-154 (95.00±2.89), K-9107 (98.33±1.67), K-7903 (89.33±9.68), WR-544 (83.33±3.33), LOK-1 (83.00±8.89), PBW-373(85.00±2.89), PBW-550 (90.00±10.0), WH-711 (96.23±3.77), SONALIKA (98.04±1.96), WH-1025 (98.50±1.50), RAJ-3777, (98.33±1.67), KUNDAN (97.17±2.83%) and HD-2894 (80.00±5.77%). Seeds need to have enough water for critical activities and the start of germination. If water absorption is impaired or proceeds slowly activities inside the seed will be too slow and increases duration exiting the radicle of seeds and the expression decreases germination rate. Therefore, with a more negative osmotic potential solution been troubled water absorption (Gholamin and Khayatnezhad, 2010). Buriro *et al*. (2011) reported 88 in Moomal-2000, 96 in TJ-83, 96 in Imdad-2005, 90.3 in Abadgar-93 and 88.6 per cent germination in Mehran-89 wheat varieties of Pakistan. During this period, reserve materials are degraded, commonly used for respiration and synthesis of new cells prior to developing embryo **(**Vidal-Valverde *et al.*, 2012). Several studies on the effect of germination in legumes found that germination can increase protein content and dietary fibre, reduce tannin and phytic acid content and increase mineral bioavailability (Ghavidel and Prakash, 2007).

Seed moisture :

It is clear from the Table 1 that among all varieties, minimum seed moisture was reported in HUW-234 (10.03±1.08) and maximum was recorded in WH-711 (14.03±0.55) followed by DBW-17 (10.92±0.65), WH-1021 (11.17±0.44), HD-2894 (10.90±0.59), PBW-502 (11.13±0.47), PBW-226 (11.50±0.87), RAJ-3765 (12.17±0.44), PBW-154 (11.20±0.61), K-9107 (13.17±0.60), K-7903 (12.37±0.32), WR-544 (12.23±0.62), LOK-1 (12.77±0.62), PBW-373 (12.73±0.27), PBW-550 (11.30±0.35), SONALIKA (13.03±0.58), WH-1025 (11.40±0.70), RAJ-3777 (12.40±0.31), KUNDAN (11.17±0.60) and HW-2045 (11.77±0.23%). Seed quality is very important to optimum growth and yield production in farm which influenced by many factors such as genetic characteristics, viability, germination per cent, vigour, moisture content, storage conditions, survival ability and

seed health, but their most important is germination per cent and vigour (Akbari *et al*., 2004). Sawant *et al*. (2012) reported 11.2 per cent seed moisture content in LOK-1. Similar results in Kanchan (9.95±0.06), Sonalica (10.20±0.08), Provati (10.40±0.08), Akbar (10.06±0.04), Gaurav (12.30±0.06), Barkat (11.70±0.40), Ananda (10.51±0.20), Pavon (9.95±0.06), Kheri (10.20±0.08), Balaka (10.40±0.08) and Aghrani (12.40±0.06%) moisture in Bangladesh wheat seeds were found by Paul and Shaha (2004). Symmons *et al*. (1983) proposed grain moisture percentage to be used as an indication, which correlates better with physiological development. Such approach enables direct comparisons to be made between results reported by different investigators. Based on these considerations in the present investigation stage of wheat seed development was determined by measuring seed moisture content.

Seedling length :

The data shown in Table 1 clearly revealed that among all varieties, maximum seedling length was significantly reported in HD-2894 (16.80±0.35) followed by DBW-17 (16.03±0.09), WH-1021 (15.43±0.24), PBW-502 (13.80±0.15), PBW-226 (11.47±0.24), RAJ-3765 (11.07±0.23), HUW-234 (10.23±0.22), K-9107 (12.27±0.09), K-7903 (12.60±0.15), WR-544 (12.43±0.18), LOK-1 (10.30±0.15), PBW-373 (10.03±0.52), PBW-550 (11.47±0.19), WH-711 (10.40±0.15), SONALIKA (13.20±0.06), WH-1025 (12.27±0.09), RAJ-3777 (13.83±0.15), KUNDAN (12.73±0.03) and HW-2045 (12.40±0.12), and least was reported in PBW-154 (10.13±0.03cm) while Moshatati and Gharineh (2012) reported 24.55cm seedling length of Pishtaz wheat variety after 7 days of germination. In seeds, increasing of osmotic potential decreased root and shoot length and weight, which were harder to attribute this reduction in length and weight of shoot (Jiriaie *et al*., 2013). It has been shown that seeds removed in the fresh state from mother plant will germinate either after achievement of maximum dry weight, followed by the beginning of water loss or after imposed artificial drying (Black *et al*., 1999).

Seed weight :

The seed weights of twenty wheat varieties are

Table 1 : Comparison of physiological parameters of some wheat varieties

Wheat varieties	Germination (%)	Seed moisture (%)	Seedling length (cm)	Seed weight (g/100seeds)	Seedling weight (mg)
DBW-17	96.67±3.33	10.92±0.65	16.03±0.09	4.74±0.03	17.67±0.33
WH-1021	96.73±3.26	11.17±0.44	15.43±0.24	4.31±0.03	13.67±0.33
HD-2894	80.00±5.77	10.90±0.59	16.80±0.35	4.47±0.02	15.07±0.07
PBW-502	86.67±3.33	11.13±0.47	13.80±0.15	3.94±0.00	14.10±0.10
PBW-226	96.67±3.33	11.50±0.87	11.47±0.24	3.76±0.03	8.00±0.58
RAJ-3765	96.67±3.33	12.17±0.44	11.07±0.23	3.64±0.04	9.13±0.13
HUW-234	83.33±3.33	10.03±1.08	10.23±0.22	5.03±0.04	10.33±0.33
PBW-154	95.00±2.89	11.20±0.61	10.13±0.03	3.95±0.28	10.20±0.20
K-9107	98.33±1.67	13.17±0.60	12.27±0.09	4.24±0.03	10.67±0.33
K-7903	89.33±9.68	12.37±0.32	12.60±0.15	3.34±0.09	11.67±0.33
WR-544	83.33±3.33	12.23±0.62	12.43±0.18	3.71±0.02	9.23±0.23
LOK-1	83.00±8.89	12.77±0.62	10.30±0.15	5.11±0.07	11.67±0.33
PBW-373	85.00±2.89	12.73±0.27	10.03±0.52	3.65±0.21	11.17±0.17
PBW-550	90.00±10.0	11.30±0.35	11.47±0.19	4.11±0.01	15.33±0.33
WH-711	96.23±3.77	14.03±0.55	10.40±0.15	3.78±0.03	11.67±0.33
SONALIKA	98.04±1.96	13.03±0.58	13.20±0.06	4.02±0.04	11.67±0.33
WH-1025	98.50±1.50	11.40±0.70	12.27±0.09	4.38±0.08	13.33±0.33
RAJ-3777	98.33±1.67	12.40±0.31	13.83±0.15	4.22±0.03	14.67±0.33
KUNDAN	97.17±2.83	11.17±0.60	12.73±0.03	4.23±0.04	12.33±0.33
HW-2045	98.92±1.08	11.77±0.23	12.40±0.12	4.41±0.08	13.67±0.33
CD	13.25	1.68	0.58	0.25	0.89
CV%	8.68	8.56	2.84	3.65	4.38

All value are expressed as Mean ± SEM of triplicate data (n=3) observed at 5% significance

depicted in Table 1. Among all varieties, maximum seed weight was reported in LOK-1 (5.11±0.07) and least was recorded in K-7903 (3.34±0.09) followed by DBW-17 (4.74±0.03), WH-1021 (4.31±0.03), HD-2894 (4.47±0.02), PBW-502 (3.94±0.00), PBW-226 (3.76±0.03), RAJ-3765 (3.64±0.04), HUW-234 (5.03±0.04), PBW-154 (3.95±0.28), K-9107 (4.24±0.03), WR-544 (3.71±0.02), PBW-373 (3.65±0.21), PBW-550 (4.11±0.01), WH-711 (3.78±0.03), SONALIKA (4.02±0.04), WH-1025 (4.38±0.08), RAJ-3777 (4.22±0.03), KUNDAN (4.23±0.04) and HW-2045 (4.41±0.08g). Nedeva and Nicolova (1999) reported that after flowering and during grain filling period of wheat, decreased the moisture per cent and increased the dry matter per cent (dry grain weight) and germination per cent. Maturation in cereal seeds occurs midway or late in seed development as ABA levels rise (Grilli *et al*., 1989 and Lopes and Larkins, 1993). Abdoli and Saeidi (2012) reported Bahar (42.1), Parsi (45.4), Pishtase (46.6), Pishgam (43.2), Chamran (43.2), Zarin (39.2), Sivand (45.5), Marvdasht (36.7) and DN-11 (39.9g/ 1000seeds) seed weight. The amount water taken up by seeds for 48 h of germination is small and does not exceed 2–3 times dry weight of seed (Bewley and Black, 1978).

Seedling fresh weight :

It is clear from the Table 1 that among all varieties, maximum seedling weight was reported in DBW-17 (17.67±0.33) and least was reported in PBW-226 (8.00±0.58) followed byWH-1021 (13.67±0.33), HD-2894 (15.07±0.07), PBW-502 (14.10±0.10), RAJ-3765 (9.13±0.13), HUW-234 (10.33±0.33), PBW-154 (10.20±0.20), K-9107 (10.67±0.33), K-7903 (11.67±0.33), WR-544 (9.23±0.23), LOK-1 (11.67±0.33), PBW-373 (11.17±0.17), PBW-550 (15.33±0.33), WH-711 (11.67±0.33), SONALIKA (11.67±0.33), WH-1025 (13.33±0.33), RAJ-3777 (14.67±0.33), KUNDAN (12.33±0.33) and HW-2045 (13.67±0.33mg). Seeds play an important role in determining the success of wheat culture. Thus, selection of good quality seeds is considered a primary factor in ensuring high yields. Seedling emergence and subsequent early growth affect final yields in cereals. Variations in field emergence, particularly under poor management are attributed to differences in seed vigour. Seed with low vigour either emerge late or produce abnormal seedlings, resulting in poor yields. Seeding vigour of the seedlings grown from seed is also affected by the position of that seed on its mother plant. Variation in moisture content of seeds from various positions in the head may be due to variation in the chemical composition of the seeds, and is a source of variation between seeds in storability and seed vigour (Mohsen *et al*., 2012). Moshatati and Gharineh (2012) reported 0.0166g seedling weight of Pishtaz wheat variety after 7 days of germination.

Conclusion :

It is concluded from the present study that HW-2045 have higher germination rate in all twenty-wheat variety. Wheat demand is inelastic and tightly linked to population growth in many countries. Therefore, according to physiological aspect variety should grow for better quality seed and cultivation but result in more seedling growth and more seedling weight that this object may be result in better seedling establishment and higher plant growth and production more yield in field.

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