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Effect of treatment on seed storage and physiological characters of chickpea

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Abstract
An experiment on storage was conducted at Naini Agricultural Institute SHUATS Allahabad, 211007 Uttar Pradesh during 2016 - 2017 on Bengalgram C1015. The seeds are treated with polymer, KH_2PO_4, Imidacloropid, Pseudomonas, neem leaf extract with different combinations. The treated seeds are stored in polythene bag (700 gauge) at ambient conditions for assessment of seed germination, shoot length, root length, seedling length, seedling fresh matter and dry matter, seedling vigour indices, and protein &and carbohydrate content where data was subjected to factorial experiment laid out in completely randomized design. Germination percentage, root length, shoot length, seedling length, seedling dry weight, seed vigour mass seed vigour index. Among the treatments, polymer +neem leaf extract of seeds (T_9) recorded higher germination percent shoot length, root length, seedling length, fresh weight, dry weight, vigour index I, vigour index II. The polymer coated seeds treated with insecticide and Biocide (T_{11}), recorded significantly high seed protein & carbohydrate (%) compared to untreated seeds. at the end of 6th month of storage period.

Keywords: Physiological characters, chickpea, leguminous plants

Introduction

Pulses are the edible dry seeds of leguminous plants. They are of special nutritional and economic importance due to their contribution to the diets of millions of people worldwide. The importance of pulses lies primarily in their high protein content besides being a valuable source of energy. In addition, pulses also contain good amount of nutritionally rich essential minerals and vitamins such as calcium, phosphorus, iron and vitamin C. The use of pulses as food is concentrated in developing countries, which account for about 90 per cent of global human pulse consumption.

Bengalgram, which is called chickpea or gram (*Cicer arietinum* L.) in South Asia, is one of the important pulses in developed world. It is a major pulse crop in India widely grown for centuries and accounts for nearly 40 % of the total pulse production. India is one of the major growing countries of the world, accounting for 62 % of the total world production [1]. Polymer coating makes sowing operation easier due to the smooth flow of seeds. Addition of colourant helps in visual monitoring of placement accuracy, enhance the appearance, marketability and consumer preference. The polymer film coat may act as a physical barrier, which has been reported to reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo [2]. The detailed information on these aspects of Bengal gram is lacking and thus deserves the attention of understanding the above aspects that would be much of practical significance to improve the seedling parameters of stored seed. Hence, an investigation was carried out to know "Effect of treatment on seed storage and physiological characters of chickpea" is carried with following objectives.

1. To evaluate the effects of seed treatment with polymer coating, chemicals and bio fertilizers over the seedling parameters after storage of chickpea seeds.
2. To evaluate the increase or decrease of Protein, carbohydrate, content of treated seeds after storage period.

Materials and methods

The Bengal gram C1015 seeds obtained from Department of Genetics and Plant Breeding, SHUATS were coated with polymer in combination with chemical (KH2PO4 1%) bio agent (Pseudomonas @10g/kg), Insecticide (Imidacloprid @2ml/kg) biocide (neem leaf extract)T. First part is control T0, second part treated with Fortification chemical (KH2PO4) (T1,) Third part of seeds treated with Bioagent (Pseudomonas) (T2), Fourth part of seeds treated with (Imidacloprid) (T3), and Fifth part of seed treated with Biocide (neem leaf extract) (T4), Sixth part of seed is treated with Polymer (Cistocoat PL-Blue @ 6ml /kg) (T5), Seventh part of seed treated with Polymer + T1 =(T6), Eight part of seed treated with Polymer +T2= (T7), Ninth part of seed treated with Polymer +T3=(T8), Tenth part of seed treated with Polymer+T4=(T9), Eleventh part of seed treated with Polymer T1+T2= (T10), Twelfth part of seed treated with Polymer +T3+T4= (T11), thirteen part of seed treated with F+ Bio+ Ins+ neem+ Polymer= (T12) treated seeds were packed in polythene bag (700 gauge) for assessment seed germination, shoot length, root length, seedling length, seedling fresh matter & dry matter, seed vigour mass, seed vigour index and protein & carbohydrate of where data was subjected to factorial experiment laid out in completely randomized design. After imposition of seed treatments, the treated seeds were packed in polythene bag 700 guage and stored under ambient conditions at Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom university of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh for six months i.e. from July 2016 to January 2017. The seed samples drawn after storage period were evaluated for various seed quality attributes in order to determine the suitable treatment for better storage.

Standard germination test was conducted in the laboratory as per ISTA [3] by formula:

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds} \times 100}$$

The ten normal seedlings which were selected for measuring seedling length were kept in a butter paper and dried in a hot air oven at 103°C temperature for 24 hr later allowed to cool for 30 minutes and the dry weight was recorded and expressed in grams as per [4].

vigour index was calculated using the formula given by [5].

VI = Seedling length (cm) × Germination percentage (%)

Protein content was estimated from bengal gram seed by using Lowry's method [6]. Carbohydrate content was estimated from Bengal gram seed by using Lowry's method [7].

Results

Germination Percent

Among the treatments Non significantly higher germination was recorded with seeds treated with polymer + neem leaf extract of seeds (T9) at the end of storage period (98.00). Non significantly lower seed germination was recorded throughout the storage period with untreated control (T_0) which recorded germination percentage (70.00) at the end of 6th month of storage.

Root Length (cm)

There was Significantly higher root length (cm) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9) at the end of storage period (15.47) due to higher seed germination. Significantly lower seed root length (cm) was recorded throughout the storage period with untreated control (T_0) which recorded root length (9.68) at the end of 6th months of storage period.

Shoot length (cm)

Significantly higher shoot length (cm) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9)) at the end of storage period (10.22). Significantly lower seed shoot length (cm) was recorded throughout the storage period with untreated control (T_0) which recorded shoot length (6.88) at the end of 6th months of storage.

Seedling length (cm)

Seedling vigour index gradually decreased with period of seed storage in all the treatments. Significantly higher seedling length (cm) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9)) at the end of storage period (24.00). Significantly lower seed seedling length (cm) was recorded throughout the storage period with untreated control (T_0) which recorded seedling length (17.31) at the end of 6^{th} months of storage.

Fresh weight of seedlings (gm)

Significant differences in seedling dry weight were observed in seed treatments, higher fresh weight of seedlings (gm) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9) at the end of storage period (7.90). Significantly lower seed fresh weight seedlings (gm) was recorded throughout the storage period with untreated control (T_0) which recorded fresh weight of seedling (5.56) at the end of 6^{th} months of storage.

Dry weight of seedlings (gm)

Significant differences in seedling dry weigh were observed in seed treatments and storage containers, higher dry weight of seedlings (gm) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9) at the end of storage period (1.53). Significantly lower dry weight of seedlings (gm) was recorded throughout the storage period with untreated control (T_0) which recorded dry weight of seedling (0.59) at the end of 6^{th} months of storage.

Seed vigour I

Significantly higher seed vigour I (%) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9) at the end of storage period (124.37). Significantly lower seed viability (%) was recorded throughout the storage period with untreated control (41.30) at the end of 6^{th} months of storage.

Seed vigour index II

Highest seed vigour index (%) was recorded with seeds treated with polymer +neem leaf extract of seeds (T9) at the end of storage period (2312.05). Significantly lower seed vigour indedx (%) was recorded throughout the storage period with untreated control (1210.85) at the end of 6^{th} months of storage.

Seed protein content

At the end of six months period of seed storage, the seed treatments, protein (%) was recorded higher with Polymer +T3+T4 = (T11), at the end of storage period (19.18). Significantly lower seed protein (%) was recorded throughout the storage period with untreated control T0 (15.54) at the end of 6^{th} months of storage.

Seed carbohydrate content

At the end of six months period of seed storage, the seed treatments, with Polymer +T3+T4 = (T11), at the end of storage period (35.23). Significantly lower seed carbohydrate (%) was recorded throughout the storage period with untreated control (---) at the end of 6^{th} months of storage.

S. No.	Treatments	Before Storage Germination percent	After storage Germination percent	Before Storage Root Length (cm)	After storage Root Length (cm)	Before Storage Shoot Length (cm)	After storage Shoot Length (cm)	Before Storage Seedling Length (cm)	After storage Seedling Length (cm)
1	T_0	80.00	70.00	15.20	9.68	8.90	6.88	24.10	17.31
2	T_1	82.25	90.00	17.82	13.39	9.52	8.29	26.67	21.56
3	T_2	84.75	80.00	17.01	14.40	9.10	8.87	26.16	23.27
4	T_3	85.00	88.00	18.22	15.93	8.12	8.43	26.34	23.86
5	T_4	90.00	86.00	16.77	15.46	11.32	8.54	28.09	22.93
6	T5	84.25	84.00	15.84	13.39	9.52	8.09	25.87	21.48
7	T6	99.00	95.25	19.25	15.44	12.42	9.96	31.67	22.52
8	T7	85.00	64.50	17.83	11.44	11.20	8.33	29.20	19.77
9	T8	92.00	69.00	19.22	11.62	11.50	8.53	30.72	20.65
10	T9	100.00	98.00	19.36	15.47	12.98	10.22	32.34	24.00
11	T10	89.00	76.00	16.75	11.62	11.22	8.27	27.99	19.89
12	T11	90.00	81.25	17.89	10.51	12.20	9.70	30.09	20.71
13	T12	92.00	80.00	18.36	13.03	11.19	9.25	29.55	22.39
Grand Mean		88.71	81.69	17.66	13.18	10.71	8.72	28.37	21.56
F- test		S	S	S	S	S	S	S	S
S. Ed. (±)		0.555	0.405	0.001	0.003	0.019	0.003	0.338	0.693
C. D. (P = 0.05)		1.177	0.859	0.002	0.007	0.040	0.006	0.717	1.470

S. No.	Treatments	Before Storage Fresh Weight of Seedling (gm	After storage Fresh Weight of Seedling (gm	Before Storage Dry Weight of Seedling (mg)	After storage Dry Weight of Seedling (mg)	Before Storage Seed Vigour Index Length	After storage Seed Vigour Index Length	Before Storage Seed Vigour Index Mass	After storage Seed Vigour Index Mass
1	T_0	5.40	5.56	1.02	0.59	81.33	41.30	1938.55	1210.85
2	T_1	5.55	5.40	1.20	1.27	98.38	91.73	2187.13	1940.18
3	T_2	6.09	6.32	1.08	1.01	92.04	90.15	2226.08	1861.58
4	T_3	6.81	6.81	1.19	1.06	100.28	101.64	2238.63	2141.88
5	T_4	5.70	5.70	1.19	1.28	107.10	108.32	2527.40	2063.55
6	T5	7.07	7.07	1.32	1.27	121.85	84.96	2179.23	1807.68
7	T6	7.80	7.80	1.50	1.45	140.48	120.93	3134.80	2383.45
8	T7	7.10	7.10	1.21	1.03	102.83	76.91	2482.05	1450.43
9	T8	6.73	6.91	1.10	1.26	101.21	118.42	2879.60	1407.34
10	T9	7.90	7.90	1.54	1.53	144.00	124.37	3234.00	2312.05
11	T10	6.35	6.35	1.21	1.30	107.65	96.53	2490.95	1636.30
12	T11	6.98	6.98	1.25	1.15	112.48	79.49	2640.18	1681.75
13	T12	7.17	7.17	1.25	1.08	114.98	85.12	2716.00	1762.50
Grand Mean		6.67	6.70	1.24	1.17	110.20	93.99	2528.81	1819.96
F- test		S	S	S	S	S	S	S	S
S. Ed. (±)		0.068	0.085	0.004	0.004	4.426	13.087	47.038	91.712
C. D. (P = 0.05)		0.144	0.180	0.008	0.008	9.383	27.744	99.722	194.430

S.NO.	Treatments	Protein content	Carbohydrate
1	T_0	15.54	32.68
2	T_1	16.23	32.45
3	T_2	16.48	33.13
4	T_3	16.83	32.68
5	T_4	16.65	33.68
6	T5	17.50	33.73
7	T6	18.13	34.10
8	T7	18.03	33.33
9	T8	17.73	34.18
10	T9	17.63	33.65
11	T10	18.73	34.83
12	T11	19.18	35.23
13	T12	18.05	34.13
Grand Mean		17.44	33.85
F- test		S	S
S. Ed. (±)		0.108	0.234
C. D. (P = 0.05)		0.228	0.496

Discussion

Germination per cent

The decline in germination percentage may be attributed to ageing effect leading to depletion of food reserves and decline in synthetic activity of embryo apart from death of seed because fungal invasion, insect damage, fluctuating temperature, relative humidity and storage container in which seeds are stored. The polymer reduced the impact of ageing enzymes, this suggests that polymer coating protective agent against seed deterioration due to fungal invasion and physiological ageing as result of which the seed viability was maintained for a comparatively longer period of time [8].

Root Length & Seedling length (cm)

The decline in root and shoot length may be attributed to age induced decline in germination. The damage caused by fungi and insects and also toxic metabolites which might have hindered the seedling growth and similar findings were also reported by [9].

Fresh weight and dry weight (gm)

Fresh weight and dry weight of seedling decreased with increase in storage period. This may be due to ageing, which resulted in seed deterioration of seed, decrease in the germination percentage and seedling length [16, 17].

Seed vigour index I &seed vigour index II

The decrease in the seed vigour mass, seed vigour index may be due to age induced decline in germination, decrease in root and shoot length and seedling dry weight and higher electrical conductivity. Higher seed vigour index in polymer coating along with biocides is due to more germination, root and shoot length, seedling dry weight, lesser infection by storage fungi and very low infestation of insects. Similar findings were reported by [8, 10-13].

protein content and carbohydrate content.

The pattern of reduction in the protein content and carbohydrate content may be related to oxidation of the amino acids, due to increase in the respiratory activity and advance in the deterioration process of the stored seeds. The decline in protein content over the storage period may be attributed to ageing effect and because of fungal invasion, insect attack, fluctuating temperature, relative humidity, increase in moisture content, and storage containers [14, 15].

Conclusion

Among the treatments seeds polymer coated with neem leaf extract (T9) recorded higher germination percentage, seed viability, seed vigour, fresh weight, dry weight, followed by polymer +kh2po4 (T6) treated seed maintained germination above minimum seed certification standard up to 6 months of storage seed treatments seeds treated with polymer + pseudomonas & imidacloroprid of seeds (T_{11}) followed by polymer + kh2po4 + pseudomonas (T_{10}), seeds recorded higher protein and carbohydrate content throughout the storage period in ambient conditions as compared to control.

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