The Pharma Innovation Journal 2023; 12(2): 3022-3026

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 3022-3026

www.thepharmajournal.com
Received: 09-12-2022
Accepted: 13-01-2023

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Seed quality of summer groundnut (*Arachis hypogaea* L.) in response to micronutrients

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Abstract
The effects of soil and foliar application of micronutrients on seed quality of summer groundnut varieties SB-XI and *Phule Unnati* (*Arachis hypogaea* L.) were investigated. The study was conducted under laboratorial condition at Seed Technology Research Unit, Mahatma Phule Krishi Vidyapeeth, Rahuri using factorial completely randomized block design (FCRBD) during 2020-2021 and 2021-2022. The result revealed that the application of micronutrients and their interaction with groundnut varieties had a significant impact on the seed quality traits of summer groundnut. The betterment of the seed quality traits of summer groundnut, particularly germination, seedling length, seedling vigour index and electrical conductivity were observed with foliar application of *Phule* liquid Micro grade II. The interaction of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II (V_2M_2) observed higher germination, seedling length, seedling vigour index and lower electrical conductivity at the end of 270 days of storage period during both the years.

Keywords: Seed quality, groundnut, micronutrients, germination, seedling length, seedling vigour index and electrical conductivity

Introduction
Groundnut is one of the world's principal oilseed and ancillary food crop designated as wonder legume. Groundnut kernels are consumed directly as raw, boiled, roasted or crushed for edible oil. Its products also used as animal feed and industrial raw material. These multiple uses of groundnut plant make it an excellent crop for domestic markets as well as for foreign trade in developing and developed countries (Rathnakumar *et al*., 2013) [11]. Globally, over 50% groundnut is crushed for extraction of oils, 37% confectionary and 12% for seed purpose (Nurezannat *et al*., 2019) [9].

Intensification of agriculture, usage of straight fertilizers rising crop requirements due to increasing productivity levels have heightened the micronutrients demand in soil fertility management. The soil application of nutrients is best for macronutrients while micronutrients act best when applied as foliar spray (Nasar *et al*., 2018) [8]. The foliar spray enables plants to absorb the applied nutrients from the solution through their leaf surface and thus, may result in the economic use of fertilizer (Helmy and Shaban, 2008) [3].

The micronutrient most often limiting for groundnut production is boron and it plays a key role in kernel quality. Boron is highly essential for proper seed setting and improvement in seed quality of groundnut (Meena *et al.*, 2007) [6]. It is evident that application of boron enhanced the oil yield and protein percentage in groundnut (Nandi *et al.*, 2020) [7]. Boron and molybdenum has the ability to improve the quality of groundnut (Nasar *et al.*, 2018) [8]. Molybdenum is also essential for nitrogen fixation and involved in several enzyme systems. (Sharma *et al*., 2017) [13]. Manganese imparts oxidation reduction process, photosynthesis, oxygen evolution and involved in many biological processes. Chlorine along with manganese is required for oxygen evolution and photosynthesis (Singh *et al.*, 2004) [14]. Manganese acts as an activator for many enzymes (Sabra *et al.*, 2019) [12]. Copper is rarely applied to the groundnut but participates in protein and carbohydrate metabolism and nitrogen fixation. It is a constituent of many enzymes and its application increases the oil yield (Singh, 2001) [14]. Therefore, the micronutrients are the way to enhance the quality of summer groundnut. Keeping in views the backdrops, the experimentations was outlined for improving the seed quality of summer groundnut.

Materials and Methods
The freshly harvested pods of groundnut varieties SB-XI and *Phule Unnati* obtained from

different treatment combinations were dried upto moisture content of 9 per cent and kept separately in HDPE bags for storage. The observations on seed quality parameters were recorded at 30 days interval.

Observations Recorded

Germination

The standard germination test for groundnut was conducted by employing Between Paper (BP) method with Towel Paper. The kernels were kept in germinator at 20 °C-30 °C temperature and the germination count was taken on 10th day. The germination was computed on the basis of number of normal seedlings obtained from the number of kernels used for the test and expressed in percentage (ISTA, 2014) [4].

Seedling length

Ten normal seedlings were taken from each replication at the 10th day of germination. The seedling length was measured. The mean of ten seedlings was computed and expressed in cm. (ISTA, 2014) [4].

Seedling vigour index

Ten seedlings were selected from germination test and used for computing the seedling vigour index and expressed as index (Abdul Baki and Anderson, 1973) [1].

Electrical conductivity

Kernels were soaked in distilled water and kept at 25±1 °C for 24 hrs in incubator. After 24 hrs of soaking gentle swirled the solution and leachate was decanted. The electrical conductivity of the seed leachate was measured and expressed in dSm^{-1} (Loeffler *et al.*, 1988 and ISTA, 2014) [5, 4].

Moisture content

Kernels were placed in aluminium box with lid and weighed. The kernels with box were dried at 103 °C±2 °C for a period 17±1 hrs. in hot air oven. The moisture content was calculated and expressed in percentage (AOAC, 2005 and Onwuka, 2018) [2, 10].

Results and Discussion

The data pertaining to seed quality traits *viz.*, germination, seedling length, seedling vigour index and electrical conductivity of summer groundnut as influenced by varieties and micronutrients and their interactions are presented in Table 1, 2, 3 and 4.

Germination

It was observed that the germination of summer groundnut dropped down gradually with the advancement in storage period. It was reported that the interactions of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) exhibited higher germination (76.00, 73.75 and 74.88%) followed by the interaction of groundnut variety *Phule Unnati* and soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing (V_2M_1) (75.25, 74.25 and 74.75%) at 270 days of storage during 2020, 2021 and on pooled basis, respectively. The interaction effect of the groundnut variety *Phule Unnati* with foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing exhibited the higher germination. Nasar *et al*. (2018) [8] said that although micronutrients may be supplied to plants in two different ways *i.e.* soil and foliar, foliar application was the most effective method. Application of micronutrients was associated with the highest germination of summer groundnut (Sharma *et al*., 2017) [13].

Seedling length

The data showed that the seedling length of summer groundnut decreased slowly with the advancement in storage period. It was observed that the interactions of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) exhibited higher seedling length (18.11, 16.85 and 17.48 cm) followed by the interaction of groundnut variety *Phule Unnati* and soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing (V_2M_1) (17.56, 16.25 and 16.90 cm) at 270 days of storage during 2020, 2021 and on pooled basis, respectively. The interaction between *Phule Unnati*, a groundnut variety and *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing application foliarly recorded the highest seedling length. Nasar *et al*. (2018) [8] said that although micronutrients may be supplied to plants in two different ways *i.e.* soil and foliar, foliar application was the most effective method. Application of micronutrients was associated with the highest root length of summer groundnut (Sharma *et al*., 2017) [13].

Seedling vigour index

It was found that the seedling vigour index of summer groundnut dropped down gradually with the advancement in storage period. It was noticed that the interactions of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) exhibited higher seedling vigour index I (1389, 1262 and 1325) followed by the interaction of groundnut variety *Phule Unnati* and soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing (V_2M_1) (1332, 1208 and 1270) at 270 days of storage during 2020, 2021 and on pooled basis, respectively. The interaction impact of the groundnut variety *Phule Unnati* with foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing showed the maximum seedling vigour index I. Nasar *et al*. (2018) [8] said that although micronutrients may be supplied to plants in two different ways *i.e.* soil and foliar, foliar application was the most effective method.

Electrical conductivity

It was reported that the electrical conductivity of summer groundnut increased gradually with the advancement in storage period. It was recorded that the interactions of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) exhibited lower electrical conductivity (1.174, 1.280 and 1.227 dSm^{-1}) followed by the interaction of groundnut variety *Phule Unnati* and soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing (V_2M_1) (1.227, 1.335 and 1.281 dSm^{-1}) at 270 days of storage during 2020, 2021 and on pooled basis, respectively. The interaction between the *Phule Unnati* groundnut variety and the foliar application of *Phule* liquid Grade II @ 1.0% at 35 and 45 days after sowing seen the lowest electrical conductivity. Nasar *et al*. (2018) [8] said that although micronutrients may be supplied to plants in two different ways *i.e.* soil and foliar, foliar application was the most effective method.

Moisture content

It was revealed that the moisture content of groundnut seed showed non-significant differences due to the interaction effect of groundnut varieties and micronutrients application on moisture content of summer groundnut showed non-significant differences during storage.

Table 1: Interaction of groundnut varieties and micronutrients application on germination (%) of summer groundnut during storage

Treatment	0 DAS			30 DAS			60 DAS			90 DAS				120 DAS	
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
Variety × Micronutrient (V × M)															
V_1M_0	88.25 (69.96)	86.75 (68.66)	87.50 (69.31)	86.00 (68.05)	84.50 (66.83)	85.25 (67.44)	83.50 (66.04)	82.00 (64.90)	82.75 (65.47)	79.75 (63.26)	78.25 (62.21)	79.00 (62.73)	76.00 (60.68)	74.50 (59.68)	75.25 (60.18)
V_1M_1	88.00 (69.76)	87.00 (68.93)	87.50 (69.35)	86.25 (68.25)	85.25 (67.45)	85.75 (67.85)	84.00 (66.44)	83.25 (65.85)	83.63 (66.14)	81.25 (64.34)	80.25 (63.62)	80.75 (63.98)	78.00 (62.03)	77.00 (61.35)	77.50 (61.69)
V_1M_2	88.25 (69.97)	86.75 (68.68)	87.50 (69.33)	86.75 (68.68)	85.25 (67.43)	86.00 (68.06)	84.75 (67.02)	83.25 (65.85)	84.00 (66.43)	81.75 (64.72)	80.25 (63.62)	81.00 (64.17)	79.00 (62.73)	77.50 (61.70)	78.25 (62.21)
V_2M_0	91.00 (72.55)	90.00 (71.60)	90.50 (72.08)	89.75 (71.37)	88.25 (69.96)	89.00 (70.67)	88.00 (69.74)	86.25 (68.24)	87.13 (68.99)	85.25 (67.42)	84.00 (66.46)	84.63 (66.94)	83.25 (65.85)	81.50 (64.55)	82.38 (65.20)
V_2M_1	91.00 (72.55)	90.25 (71.88)	90.63 (72.22)	89.75 (71.37)	88.75 (70.41)	89.25 (70.89)	88.00 (69.74)	87.25 (69.08)	87.63 (69.41)	86.00 (68.05)	85.75 (67.85)	85.88 (67.95)	84.25 (66.66)	83.75 (66.26)	84.00 (66.46)
V_2M_2	91.00 (72.55)	90.00 (71.60)	90.50 (72.08)	89.75 (71.37)	89.00 (70.71)	89.38 (71.04)	88.25 (69.96)	87.25 (69.10)	87.75 (69.53)	86.75 (68.66)	85.50 (67.63)	86.13 (68.14)	85.00 (67.22)	83.25 (65.85)	84.13 (66.53)
SEm (±)	0.211	0.929	0.953	0.147	0.742	0.756	0.435	0.440	0.619	0.521	0.624	0.813	0.723	0.827	1.098
CD @ 1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	150 DAS			180 DAS			210 DAS			240 DAS				270 DAS	
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	72.25 (58.21)	70.25 (56.95)	71.25 (57.58)	67.00 (54.94)	65.00 (53.73)	66.00 (54.33)	64.00 (53.13)	62.00 (51.94)	63.00 (52.54)	60.75 (51.21)	58.75 (50.04)	59.75 (50.62)	57.25 (49.17)	55.00 (47.87)	56.13 (48.52)
V_1M_1	74.25 (59.51)	73.00 (58.70)	73.63 (59.10)	69.25 (56.33)	68.00 (55.56)	68.63 (55.94)	66.75 (54.79)	65.25 (53.88)	66.00 (54.33)	63.75 (52.98)	62.25 (52.09)	63.00 (52.54)	61.00 (51.35)	58.75 (50.04)	59.88 (50.70)
V_1M_2	75.25 (60.17)	74.00 (59.34)	74.63 (59.76)	70.50 (57.11)	69.00 (56.17)	69.75 (56.64)	68.00 (55.55)	66.00 (54.33)	67.00 (54.94)	65.25 (53.88)	63.00 (52.54)	64.13 (53.21)	62.00 (51.95)	59.75 (50.62)	60.88 (51.28)
V_2M_0	81.00 (64.16)	79.00 (62.73)	80.00 (63.44)	78.00 (62.03)	76.00 (60.67)	77.00 (61.35)	76.75 (61.17)	74.75 (59.84)	75.75 (60.50)	75.25 (60.17)	73.00 (58.70)	74.13 (59.43)	73.25 (58.86)	71.00 (57.42)	72.13 (58.14)
V_2M_1	82.00 (64.90)	81.25 (64.35)	81.63 (64.62)	79.50 (63.10)	78.75 (62.55)	79.13 (62.83)	78.25 (62.21)	77.50 (61.68)	77.88 (61.95)	77.00 (61.34)	76.00 (60.67)	76.50 (61.01)	75.25 (60.17)	74.25 (59.51)	74.75 (59.84)
V_2M_2	82.75 (65.46)	81.00 (64.16)	81.88 (64.81)	80.00 (63.43)	78.25 (62.22)	79.13 (62.83)	78.75 (62.55)	77.00 (61.35)	77.88 (61.95)	77.75 (61.87)	76.00 (60.67)	76.88 (61.27)	76.00 (60.67)	73.75 (59.19)	74.88 (59.93)
SEm (±)	0.204	0.333	0.391	0.572	0.550	0.794	0.398	0.465	0.612	0.453	0.503	0.676	0.320	0.550	0.636
CD @ 1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS – Non significant **DAS** – Days after storage (Figures in parenthesis are arcsine transformed values)

V_1 – SB-XI
V_2 – *Phule Unnati*
M_0 – Control
M_1 – Soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing
M_2 – Foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing

Table 2: Interaction of groundnut varieties and micronutrients application on seedling length (cm) of summer groundnut during storage

Treatment	0 DAS			30 DAS			60 DAS			90 DAS			120 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	21.15	20.07	20.61	20.50	19.41	19.95	19.69	18.57	19.13	18.65	17.46	18.05	17.51	16.28	16.90
V_1M_1	21.37	20.21	20.79	20.98	19.80	20.39	20.46	19.26	19.86	19.75	18.54	19.15	18.90	17.68	18.29
V_1M_2	21.23	20.15	20.69	20.83	19.75	20.29	20.30	19.20	19.75	19.57	18.46	19.01	18.96	17.84	18.40
V_2M_0	21.64	20.52	21.08	21.18	20.05	20.62	20.59	19.42	20.01	19.94	18.72	19.33	19.24	18.00	18.62
V_2M_1	21.82	20.78	21.30	21.47	20.42	20.94	21.06	19.97	20.51	20.61	19.46	20.03	20.04	18.86	19.45
V_2M_2	21.81	20.75	21.28	21.52	20.45	20.99	21.15	20.07	20.61	20.75	19.65	20.20	20.26	19.13	19.69
SEm (±)	0.156	0.134	0.205	0.192	0.140	0.237	0.224	0.209	0.306	0.105	0.126	0.164	0.048	0.036	0.060
CD @ 1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.202	0.150	0.235
	150 DAS			180 DAS			210 DAS			240 DAS			270 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	16.31	15.00	15.65	14.70	13.35	14.03	13.81	12.43	13.12	12.82	11.40	12.11	11.69	10.21	10.95
V_1M_1	17.97	16.74	17.35	16.77	15.52	16.14	16.13	14.81	15.47	15.42	14.08	14.75	14.59	13.18	13.89
V_1M_2	18.05	16.88	17.47	16.80	15.63	16.21	16.16	14.92	15.54	15.47	14.19	14.83	14.63	13.33	13.98
V_2M_0	18.55	17.25	17.90	17.61	16.27	16.94	17.22	15.86	16.54	16.76	15.38	16.07	16.17	14.75	15.46
V_2M_1	19.45	18.25	18.85	18.69	17.46	18.08	18.38	17.13	17.75	18.03	16.74	17.38	17.56	16.25	16.90
V_2M_2	19.75	18.59	19.17	19.06	17.89	18.47	18.78	17.59	18.19	18.50	17.28	17.89	18.11	16.85	17.48
SEm (±)	0.044	0.049	0.066	0.062	0.061	0.087	0.049	0.077	0.091	0.037	0.080	0.088	0.017	0.058	0.060
CD @ 1%	0.185	0.205	0.258	0.258	0.254	0.338	0.202	0.319	0.352	0.154	0.332	0.342	0.070	0.240	0.234

NS – Non significant **DAS** – Days after storage

V_1 – SB-XI **V_2** – *Phule Unnati*
M_0 – Control
M_1 – Soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing
M_2 – Foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing

Table 3: Interaction of groundnut varieties and micronutrients application on seedling vigour index of summer groundnut during storage

Treatment	0 DAS			30 DAS			60 DAS			90 DAS			120 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
Variety (V)															
V_1M_0	1875	1751	1813	1773	1652	1713	1652	1530	1591	1500	1376	1438	1344	1220	1282
V_1M_1	1892	1768	1830	1823	1700	1762	1736	1612	1674	1620	1498	1559	1485	1367	1426
V_1M_2	1885	1760	1822	1816	1693	1754	1727	1604	1665	1607	1487	1547	1510	1393	1452
V_2M_0	1981	1855	1918	1908	1783	1845	1814	1687	1750	1714	1583	1648	1611	1479	1545
V_2M_1	1993	1885	1939	1934	1825	1879	1865	1752	1809	1791	1672	1731	1701	1581	1641
V_2M_2	1995	1878	1937	1943	1827	1885	1880	1761	1820	1811	1691	1751	1728	1607	1668
SEm (±)				13.395	14.768	19.938	12.223	10.782	16.299	16.546	11.264	20.016	6.823	5.604	8.829
CD @ 1%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	28.433	23.353	NS
	150 DAS			180 DAS			210 DAS			240 DAS			270 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	1187	1063	1125	993	875	934	894	777	835	787	675	731	675	565	620
V_1M_1	1344	1230	1287	1173	1065	1119	1087	975	1031	994	885	940	892	781	837
V_1M_2	1366	1254	1310	1193	1082	1138	1107	990	1049	1017	901	959	912	801	856
V_2M_0	1510	1376	1443	1380	1246	1313	1327	1193	1260	1266	1132	1199	1191	1056	1124
V_2M_1	1609	1489	1549	1494	1375	1434	1448	1328	1388	1398	1275	1336	1332	1208	1270
V_2M_2	1643	1522	1583	1534	1414	1474	1491	1370	1431	1448	1324	1386	1389	1262	1325
SEm (±)	8.380	7.245	11.078	6.402	5.207	8.252	6.805	7.115	9.846	8.677	6.611	10.909	8.003	5.476	9.697
CD @ 1%	34.923	30.193	NS	26.680	21.697	32.093	28.360	29.651	38.291	36.160	27.550	42.424	33.349	22.818	37.711
NS – Non significant							**DAS** – Days after storage								

V_1 – SB-XI
V_2 – *Phule Unnati*
M_0 – Control
M_1 – Soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing
M_2 – Foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing

Table 4: Interaction of groundnut varieties and micronutrients application on electrical conductivity (dSm^{-1}) of summer groundnut during storage

Treatment	0 DAS			30 DAS			60 DAS			90 DAS			120 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	0.265	0.314	0.290	0.372	0.433	0.402	0.536	0.604	0.570	0.758	0.842	0.800	1.014	1.114	1.064
V_1M_1	0.256	0.294	0.275	0.333	0.380	0.356	0.460	0.515	0.488	0.642	0.703	0.672	0.872	0.939	0.906
V_1M_2	0.253	0.289	0.271	0.329	0.374	0.352	0.459	0.510	0.484	0.645	0.702	0.674	0.811	0.873	0.842
V_2M_0	0.255	0.300	0.278	0.323	0.375	0.349	0.438	0.499	0.468	0.568	0.641	0.605	0.711	0.794	0.752
V_2M_1	0.248	0.283	0.266	0.304	0.347	0.325	0.392	0.442	0.417	0.492	0.555	0.523	0.619	0.689	0.654
V_2M_2	0.246	0.278	0.262	0.297	0.334	0.315	0.382	0.425	0.404	0.479	0.528	0.503	0.599	0.658	0.629
SEm (±)	0.003	0.001	0.003	0.005	0.004	0.006	0.003	0.004	0.004	0.005	0.005	0.006	0.011	0.009	0.012
CD @ 1%	NS	NS	NS	NS	NS	NS	0.012	0.017	0.016	0.022	0.024	0.026	0.048	0.039	0.048
	150 DAS			180 DAS			210 DAS			240 DAS			270 DAS		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
V_1M_0	1.302	1.425	1.364	1.711	1.856	1.784	1.967	2.130	2.048	2.253	2.435	2.344	2.596	2.810	2.703
V_1M_1	1.139	1.213	1.176	1.504	1.590	1.547	1.722	1.833	1.778	1.963	2.087	2.025	2.255	2.413	2.334
V_1M_2	1.073	1.142	1.108	1.431	1.524	1.477	1.643	1.768	1.705	1.869	2.014	1.942	2.158	2.321	2.240
V_2M_0	0.860	0.955	0.908	1.064	1.175	1.119	1.161	1.279	1.220	1.268	1.394	1.331	1.405	1.544	1.474
V_2M_1	0.756	0.832	0.794	0.939	1.022	0.980	1.022	1.112	1.067	1.110	1.209	1.160	1.227	1.335	1.281
V_2M_2	0.731	0.797	0.764	0.909	0.983	0.946	0.990	1.071	1.031	1.068	1.160	1.114	1.174	1.280	1.227
SEm (±)	0.004	0.014	0.013	0.005	0.016	0.014	0.011	0.009	0.013	0.015	0.016	0.019	0.018	0.027	0.029
CD @ 1%	0.017	0.064	0.051	0.020	0.071	0.057	0.051	0.043	0.052	0.068	0.074	0.078	0.082	0.123	0.115
NS – Non significant							**DAS** – Days after storage								

V_1 – SB-XI
V_2 – *Phule Unnati*
M_0 – Control
M_1 – Soil application of *Phule* Micro grade I @ 25 kg ha^{-1} at the time of sowing
M_2 – Foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing

Conclusions

From the experimental results it was outlined that the significant differences were reported in the results for the seed quality traits at the end of storage period during both the years and on pooled basis with the exception of moisture content. The interaction of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) had the higher germination, seedling length, seedling dry weight, seedling vigour index I and seedling vigour index II and lower electrical conductivity at the end of storage period during both the years and on pooled basis.

Therefore, it can be come to an end that the betterment of the seed quality traits of summer groundnut, particularly germination, seedling length, seedling vigour index and electrical conductivity were observed with foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing.

Therefore, it was outlined that the significant differences were reported in the results for the seed quality traits at the end of storage period during both the years and on pooled basis with the exception of moisture content. A groundnut variety *Phule Unnati* (V_2) had the higher germination, seedling length, seedling vigour index and lower electrical conductivity at the end storage period during both the years and on pooled basis. In respect of micronutrients application, the foliar application of *Phule* liquid Micro grade II (M_2) @ 1.0% at 35 and 45 days after sowing had the higher germination, seedling length, seedling vigour index and lower electrical conductivity at the end of storage period during both the years and on pooled basis. The interaction of groundnut variety *Phule Unnati* and foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing (V_2M_2) had the higher germination, seedling length, seedling dry weight, seedling vigour index I and seedling vigour index II and lower electrical conductivity at the end of storage period during both the years and on pooled basis.

From the experimental results it can be come to an end that the betterment of the seed quality traits of summer groundnut, particularly germination, seedling length, seedling vigour index and electrical conductivity were observed with foliar application of *Phule* liquid Micro grade II @ 1.0% at 35 and 45 days after sowing.

Acknowledgements

Authors are thankful to the Groundnut Breeder, AICRP on Summer Groundnut, MPKV, Rahuri for supply of high quality seeds to conduct the experiments.

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