



Research Article

EFFECT OF WATER AND CALCIUM OXYCHLORIDE TREATMENT ON GERMINATION, VIGOUR INDEX AND DRY MATTER PRODUCTION OF POD SEEDED GROUNDNUT

S. SWETHA*, T. RAGAVAN, N.S. VENKATARAMAN, P. SARAVANAPANDIAN

Agricultural College and Research Institute, Madurai, 625104, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India

*Corresponding Author: Email - swethasivakumar.96@gmail.com

Received: April 02, 2019; Revised: April 11, 2019; Accepted: April 12, 2019; Published: April 15, 2019

Abstract: The field experiment was conducted during September 2018 at Agricultural College and Research Institute, Madurai, 625 104, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, to study the effect of water and calcium oxychloride treatment on germination, vigour index and dry matter production of pod seeded groundnut. The experiment was laid out in randomized block design with 8 treatments replicated thrice. The treatments consist of control (kernel), groundnut pods soaked in water, calcium oxychloride for 18, 20 and 24 hours and untreated pods. The results of the experiment revealed that soaking in water and calcium oxychloride significantly influenced the germination percentage, vigour index and dry matter production of groundnut compared to untreated pod sowing. Soaking the pods in water for 24 hours recorded the highest germination percentage among pod sowing treatments which was followed by soaking the pods in calcium oxychloride for 24 hours. The similar trend was observed for vigour index and dry matter production.

Keywords: Pod Sowing, Groundnut, Calcium Oxychloride, Water, Vigour Index

Citation: S. Swetha, *et al.*, (2019) Effect of Water and Calcium Oxychloride Treatment on Germination, Vigour Index and Dry Matter Production of Pod Seeded Groundnut. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 7, pp.- 8272-8274.

Copyright: Copyright©2019 S. Swetha, *et al.*, This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

Groundnut (*Arachis hypogaea* L), also known as peanut is an important oilseed, food and fodder crop belonging to the family Fabaceae. It is the world's 13th most important food crop, 4th most important edible oil source and 3rd important source of vegetable protein. Groundnut seed which is rich in oil and protein content contains about 44 to 56% oil and 22 to 30% protein on dry weight basis and minerals such as phosphorus, calcium, magnesium and potassium and vitamins [1]. Asia accounts for about 50% of area and 60% production of groundnut with largest share by India (>20%). India is one of the largest producers and groundnut production occupies important position in the Indian economy. India ranks first in both area and production in the world with an area of about 5.3 million hectares and production of about 7.4 million tons. The average productivity is 1398 kg/ha. Groundnut occupies an area of 2.82 lakhs hectares in Tamil Nadu with a production of 5.8 lakh tons. The average productivity is 2084 kg/ha [2]. About 70% area under groundnut cultivation in Tamil Nadu is rainfed and remaining 30% is under irrigated condition. Nearly, around 80% of the groundnut production comes from small and marginal farmers. The normal seed rate for irrigated and rainfed conditions is about 125 kg and 140 kg per hectare respectively. The seed cost accounts for about 31.40% of the mean total variable cost [3]. Seed cost and sowing is reported to be the most expensive operation which together contribute about 45% of the total cost of groundnut production. The seed cost is increased mainly by the operation of shelling, which raises the seed cost upto 3 times. The shelling process also causes injuries and disturbance to seed through embryo fracture which reduces the germination capacity and the ability of seed to germinate at desired time to ensure an adequate level of initial growth (vigour) as reported [4]. Taking all these factors into consideration, the practise of pod seeding technology need to be exploited for increasing the yield by reducing the input cost. Pod-sowing is followed as an important technology in groundnut cultivation in southern and northern China during unsuitable conditions such as low temperature and drought [5,6].

Pod sowing includes benefits such as efficient utilization of time and labour, protection of the kernels from bird or insect damage and the pods can be safely stored for a comparatively longer time without the loss of viability. The pod seeding can also be mechanized by using seed drills for sowing as there is no concern of damaged seed coat. However, germination is reduced in pod sowing technology because of the protection provided by the shell [7,8]. The present study aims to improve the germination of unshelled pods by treating with water and 1% calcium oxychloride to soften the shell and facilitate easy emergence under pod seeded condition.

Materials and Methods

The experiment was carried out at Agricultural college and Research institute, Madurai during the year 2018. Groundnut variety VRI-2 released from Regional Research Station, Virudhachalam was used as the seed material. The experiment was laid out in randomized block design with 8 treatments. The soil of the experimental site was sandy clay loam and taxonomically known as Typic udic hapustalf. The soil was neutral in reaction with low in available N (265 kg/ha), medium in available P (16 kg/ha) and high in available K (290 kg/ha). Calcium oxychloride and water were used to treat the pods to hasten the germination. The treatments comprised of soaking the pods in 1% calcium oxychloride for 18, 20, 24 hours, soaking in water for 18, 20, 24 hours at the ratio of 1:2(pods: solution), unsoaked/dry pods and control (Kernel). The aqueous solution of 1% calcium oxychloride was prepared by dissolving 10g in 1 litre distilled water. The plots were laid out at the size of 3m × 3m and 200 pods per plot were sown. The field was irrigated sufficiently at 1DAS and 3DAS (Life irrigation) to avoid water stress. The germination was recorded at every 24-hour interval up to 15 days. On the 15th day and number of seeds germinated was expressed as per cent. For root studies, ten seedlings were then removed carefully at random from each replication in order to remove the plant intact with entire root system.

Table-1 Effect of water and calcium oxychloride treatment on germination percentage, shoot length, root length, vigour index and dry weight of groundnut pods

Treatments	Germination (%)	Plant height (cm)	Root length (cm)	Vigour index	Dry matter (g/10 plants)
T ₁ Control	85.5	14.24	7.6	1867	6.28
T ₂ CaOCl ₂ (18 hrs)	57.3	14.12	6.95	1199	5.15
T ₃ CaOCl ₂ (20 hrs)	60.3	14.57	6.94	1297	5.45
T ₄ CaOCl ₂ (24 hrs)	70	14.45	7.39	1528	5.59
T ₅ Water (18 hrs)	61.3	14.26	7.06	1306	5.54
T ₆ Water (20 hrs)	65.8	14.35	7.22	1419	4.97
T ₇ Water (24 hrs)	72.3	14.3	7.88	1603	5.69
T ₈ Dry pod (Without treatment)	46.5	14.02	6.24	894	4.63
SEd	1.37	0.23	0.32	24.95	0.13
CD (P=0.05)	2.95	NS	NS	53.53	0.27

The shoot length and root length were measured in cm. For dry matter production, seedlings removed for shoot and root length were placed in a paper cover, shade dried and dried in a hot air oven maintained at 80°C for 48 hours. It is expressed as mg/10 seedlings [9]. The vigour index of the seedlings was computed by adopting the formula proposed [10].

Vigour Index = (Shoot length + Root length) x Germination percentage (%)
Data collected under different treatments were subjected to analysis of variance (ANOVA) and means separated using Fischer protected LSD when significant differences were observed. The non-significant differences were denoted as NS.

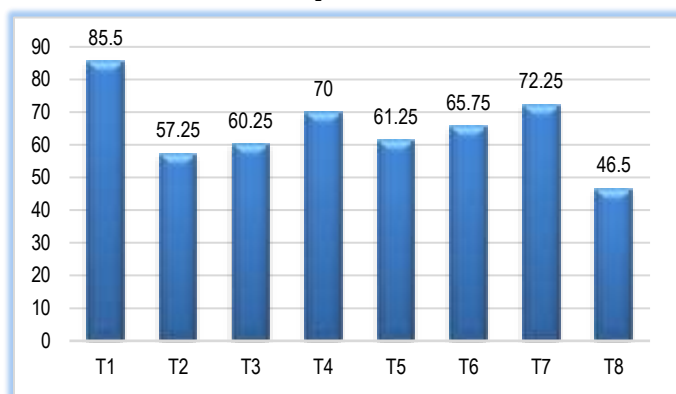


Fig-1 Germination percentage

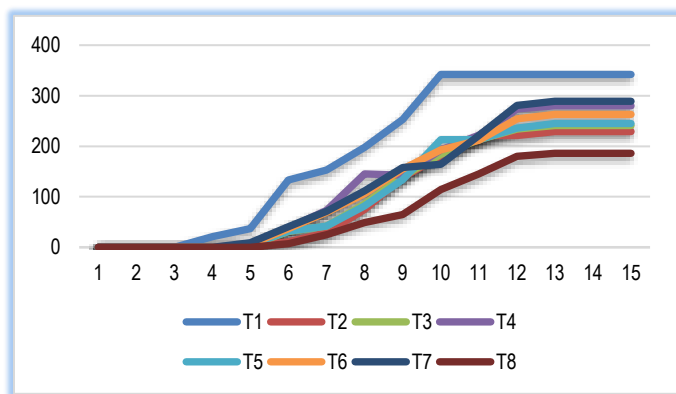


Fig-2 Rate of Germination

Results and Discussion

Germination percentage

Kernel recorded the highest germination percentage of 85.5%. Soaking of unshelled groundnut in water and calcium oxychloride softens the shell of groundnut and thereby facilitates the cotyledons to emerge out of the shell. The experimental results revealed significant differences in germination percentage among the different treatments. Soaking of the unshelled groundnuts in water and calcium oxychloride significantly improved the germination compared to the unsoaked groundnut pods. It was found that soaking of the unshelled groundnut in water for 24 hours and calcium oxychloride for 24 hours shows high germination percentage of 72.25% and 70% respectively, which were on par with each other. The result was in accordance with [11], who reported that soaking the seeds in

water improved the germination compared to control due to various factors such as softening of the seed coat, enzyme activation and swelling. Imbibition, the first phase of germination was found to be improved after soaking with water. Similarly, [12] suggested that calcium oxychloride removes the various germination impediments such as thick seed coats or alkaloids present in the seed coats which may prevent the absorption of water by the seed for imbibition. The least germination percentage was observed at groundnut sown without any soaking. The germination percentage increased with increased duration of soaking in both water and calcium oxychloride. In kernel, the seed germination started from 3rd day after sowing and completed on 6th day after sowing. In pod seeded groundnut the germination of groundnut started only after 5th day of sowing in water and calcium oxychloride soaked treatments because of the additional time taken by the cotyledons to come out of the shell. When the pods were sown without any soaking treatment, the germination started even a day later. The germination continued upto 12th day after sowing. This result was in line with [13]. [14] reported that sowing unshelled groundnuts delayed the germination. This may be attributed to the fact that the kernels have to break out from the covered shell. It has been observed that among the two kernels in a single pod, the one which is towards the pointed end comes out of the shell quicker than the one near the blunt end.

Shoot length and Root length

Further it was observed that seed treatments do not significantly influence the root length and shoot length. This might be due to the fact that the soaking of unshelled groundnut in water and calcium oxychloride only softened the outer shell and promoted the easy emergence. It did not have any influence on the vigour of kernels present inside.

Dry weight

At the time of observation, there was significant differences in dry weight of the seedlings among the various treatments. The kernel sowing recorded the maximum dry weight (6.28g) which was significantly superior than the rest of the treatments followed by water 24 hours (5.69g), CaOCl₂ 24 hours (5.54g), water 18 hours (5.59g) and CaOCl₂ 20 hours (5.45g), which were on par with each other. The dry pods sown without any treatment recorded least dry weight (4.63g). The result was in accordance with [15] and reported that kernel sowing registered significantly higher dry weight compared to pod sowing.

Vigour index

Low vigour of the seed is reported to be the main cause of poor establishment which ultimately results in yield reduction [16]. The vigour index was significantly higher in Kernel sown (1867) followed by pod soaking in water for 24 hours (1603) and pods soaked in calcium oxychloride for 24 hours (1528) as compared to other treatments. Retention of higher vigour by treating the pea seeds with calcium oxychloride also reported [17]. This might be due to the increased germination percentage in both the treatments. The pods sown without any soaking treatment have shown the least vigour index (894). From the above experiment, it was concluded that soaking of groundnut pods in water 24 hours showed about 55.48 % increase in germination percentage and 79.3 % increase in vigour than that of the untreated dry pods.

Application of research: To improve the germination of pod sowing groundnut thereby maintaining optimum plant population and improving the yield.

Research Category: Seed treatment

Acknowledgement / Funding: Authors are thankful to Agricultural College and Research Institute, Madurai, 625 104, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India.

***Research Guide or Chairperson of research: T. Ragavan**

University: Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu
Research project name or number: MSc Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Agricultural College and Research Institute, Madurai, 625 104, Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India

Cultivar / Variety name: VRI-2

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

References

- [1] Vinothini N., Vijayan R. and Umarani R. (2018) *International Journal of Current Microbiology and Applied Science* 7(09), 3321-3328.
- [2] Ministry of Agriculture and Farmers Welfare, Govt. of India. Report (2016-2017)
- [3] Ani D.P. (2013) *African Journal of Food, Agriculture, Nutrition and Development*, 13(4), 53-55
- [4] Marrewijk W. K. and Louwaars A.K. (1992) *CTA, Netherlands* pp.1.
- [5] Fu Xiong, Xing Min, Zhu He and Feng (2018) *Seed Science and Technology*, 46(1), 65-69.
- [6] Na Y. (2010) *Ra in Fed Crops*, 30, 431-433.
- [7] Sun Y., Li L. and Liu D. (2007) *Hunan Agricultural Sciences*, 6, 101-103.
- [8] Lu S., Wu J. and Qiu L. (2011) *Hunan Agricultural Sciences*, 11, 44-48.
- [9] Gupta P. C. (1993) *In: Handbook of seed testing (Ed. Agrawal, P.K.). DAC, Ministry of Agriculture, Govt. of India, New Delhi*, 242-249
- [10] Abdul-Baki A. A. & Anderson J. D. (1973) *Crop science*, 13(6), 630-633.
- [11] Mudasir Q., Fatima K., Haukat S.K. (2012) *Indian J. Appl. Pure Biol.* 27(1), 105-108.
- [12] Abul Hashem, Catherine Borger, Mohammad Amjad and Dave Nicholson (2018) *Grains Research and Development Corporation, Project Number*, UA00149.
- [13] Bhavanishankar Rao M., and Shrinivasalu N. (1954b) *Madras Agricultural Journal*, 12, 431-432.
- [14] Kerle (1918) *Farmer's bulletin No. 119. from Madras Agricultural Journal*, 41 (12), 431-432.
- [15] Sambhaji Hariharrao Karhale (1987) *M.Sc. (Ag.) Thesis, Department of agronomy, Marathwada Agricultural University, Farbgan.*
- [16] Jisha K. C., Vijayakumari K. & Puthur J. T. (2013) *Acta Physiologiae Plantarum*, 35, 1381-1396.
- [17] Bhattacharya and Basu (1990) *Indian Agric.*, 34 (4), 187-193.