EFFECTS OF DIFFERENT CONCENTRATION OF POTASSIUM NITRATE ON BREAKING DORMANCY OF BLACK GRAM (*VIGNA MUNGO* L.)

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ABSTRACT

Black gram (*Vigna mungo* L.) is an important pulse crop grown in many parts of India. The demand for its seed is found throughout the year but it also undergoes dormancy which makes it difficult to cultivate as and when required. In this view, the experiment was conducted with different concentration of KNO_3 to find out effective treatment for dormancy breaking in black gram. Seeds were treated with different concentration of KNO_3 viz., 0.5, 1.0, 1.5, 2.0 and 2.5% along with a control. The results revealed that black gram seeds treated with 1.0% KNO_3 show the highest germination per cent (90%), maximum root length of 9.5 cm along with comparatively high shoot length. Vigour index was also high in treating with 1.0% KNO_3 . Therefore, it can be concluded that black gram seeds with 1.0% KNO_3 found to be the most effective method for breaking the seed dormancy of black gram.

KEYWORDS: Black gram, dormancy, hard seeds, potassium nitrate, seed germination

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1. INTRODUCTION

Black gram (*Vigna mungo* L.) is one of the most important pulse crops grown throughout India. Except in India, the primary origin of the crop, it is also cultivated in Asian countries including Pakistan, Myanmar and parts of Southern Asia (Singh and Ahlawat, 2005). The coastal region in Andhra Pradesh is famous for the black gram. The seeds contain a perfect combination of essential nutrients including about 26% protein, 60 % carbohydrates, 1.5 % fat along with good proportions of vitamins, amino acids, fibre and minerals (Hartmann *et al.*, 1997). It is rich in vitamins like A, B complex and also vitamin C. It is a dual purpose *kharif* pulse crop which is also used as nutritive fodder for the milch animals. But in southern and South-eastern parts of India, it is grown in rice fallows and Rabi. It also helps in improving and sustaining the fertility status of the soil by influencing physical properties and atmospheric nitrogen fixation (Singh *et al.*, 2015).

Seed dormancy is the condition in which the viable seed fails to germinate even under favourable condition (Bewley, 1997; Finch - Savage and Leubner-Metzger, 2006). The pulses seeds have the dormancy problem generally due to the covering structures present in the (Jackson and Blundell, 1963). In pulses, the hard seed is the major problem because such seeds fail in germination. In Black gram, which is one of the major pulses in the country, is found to have about 3-4 months of seed dormancy. So, the use of some chemicals like potassium nitrate (KNO_3) has been recommended for breaking seed dormancy and promoting seed germination. KNO_3 is an effective chemical used for

dormancy breaking and the presowing treatment with this chemical is generally carried out in seed testing laboratories (Olmez *et al.*, 2004, Hartmann *et al.*, 1997). Therefore, it was thought that treatment of black gram seeds primed with different concentrations of KNO₃ may influence breaking seed dormancy, rapid germination and shoot, root establishment. Seed priming is a method to initiate the metabolic activities prior to germination and does not allow the actual radicle emergence by controlling hydration (Vinothini *et al.*, 2020; Vinothini and Bhavyasree, 2019). Priming treatment enhances seed germination and other seedling parameters in black gram (Poovarasana *et al.*, 2019). Therefore, an experiment was conducted using different concentrations of KNO₃ to find the most effective concentration for breaking seed dormancy in black gram.

2. MATERIALS AND METHODS

2.1. Collection of Seeds

The experiment was conducted at Faculty of Agricultural Sciences, SRM Institute of Science and Technology, Deemed University, Kattankulathur, Tamil Nadu – 603 203, India. Freshly harvested and genetically pure black gram (cv. ADT 6) seeds were collected from the National Pulse Research Centre (NPRC), Vamban. Purpose of this study is to analyse the effect of different concentrations of KNO₃ on breaking dormancy of black gram.

2.2. Treatments

Seeds were soaked with standardization of different concentration of KNO₃ viz., 0.5%, 1.0%, 1.5%, 2.0% and 2.5% and along with control (non-treated seeds). Seeds were soaked in the solution for three hours, followed by rinsing in water and shade-drying at room temperature for 24 h. Then following observation should be recorded such as germination per cent (%), Seedling parameters including root length, shoot length and vigour index.

2.3. Germination (%)

Germination percentage is an estimate of the viability of a population of seeds. Germination tests were conducted by roll towel method with 4 replications of 100 seeds in each treatment and kept in germination room at the temperature of 25±2 °C and relative humidity of 95±2 % was maintained. Seedlings were evaluated on the 7th day like normal seedlings, abnormal seedlings, fresh un-germinated seeds, hard seed and dead seeds (ISTA, 2012). Based on the number of normal seedling present, the germination percentage was calculated by the following formula.

$$\text{Germination \%} = \frac{\text{Number of normal seedlings}}{\text{Total number of seed sown}} \times 100$$

2.4. Root Length (cm)

From each replication, ten seedlings were selected randomly and used for measuring the root length. The root length measured from collar to the tip of the root and it expressed in centimetre.

2.5. Shoot Length (cm)

The seedlings selected for root length measurement were used for obtaining shoot length. The length is measured from collar to the tip of the primary leaf and values expressed in centimetre.

2.6. Vigour Index

Vigour index of the seedlings was estimated as suggested by Abdul-Baki and Anderson (1973) and mean values were expressed in whole numbers.

Vigour index = Germination per cent x total seedling length (cm)

RESULTS

Treatments were significantly influenced all the physiological parameters. The observed results showed that when the seeds were treated with 1% KNO₃, the highest germination percentage (90%) was obtained followed by KNO₃ 0.5% and 1.5% (78 per cent) when compared to the control (26 per cent) which had the lowest germination per cent (Fig. 1).

Treatment with KNO₃ at 1 per cent showed the maximum root length (9.5 cm) followed by KNO₃ 1.5 per cent (9.2 cm). Minimum root length recorded in control seeds (6 cm) (Fig. 2).

The maximum shoot length (25.6 cm) was recorded when the seeds were treated with 1 per cent of KNO₃ and comparatively, minimum shoot length was observed in 2.5% of KNO₃ (22.5 cm) followed by non-treated seeds (18.1 cm) (Fig. 3).

Similarly, the highest vigour index value (3159) was recorded in seeds treated with 1% KNO₃, while the lower vigour index of 627 was recorded by non-treated seeds (control) (Fig. 4). Therefore it can be concluded that treating the seeds with 1.0 % of KNO₃ was found to be most effective and could be recommended for breaking the seed dormancy of black gram.

3. DISCUSSIONS

The seed germination of 90 per cent was the highest among the treatments when the seeds were treated with 1% of KNO₃. Imbibition of 1% KNO₃ for 24 hours during seed priming found to have positive effects in wheat seeds which resulted in enhanced germination per cent as per the reports of Abnavi and Ghobadi (2012). Hegazi *et al.* (2011) found that KNO₃ may also serve as a nutrient source. Similar reports were there in sorghum also by Shehzad *et al.* (2012) with 1% KNO₃. Furthermore, the treatment of 1% KNO₃ for 24 hours in soybean improved the germination percentage of primed seed when compared with non-primed seed in both laboratory and field conditions (Mohammadi, 2009). Cirak *et al.* (2004) reported that KNO₃ improved the seed germination of many plant seeds. The maximum root length was observed when seed treated with 1% of KNO₃ with shoot length comparatively. Yazdanshenas *et al.* (2015) observed that KNO₃ treatment performs as a food supplement and a significant increasing in root and shoot growth. In corn, Nezhad *et al.* (2013) observed that the speed of germination based on mean germination time was also found to be increased by seed priming with 1% KNO₃ at 24 hours. Cavusoglu *et al.* (2017) observed that KNO₃ may show different effects on seed germination and seedling growth depending on the plant species and the concentration used. The vigour index was also recorded more in seed treated with 1% of KNO₃. Ruttanaruangboworn *et al.* (2017) reported that rice seed priming with 1% KNO₃ increased seed vigour in terms of the speed and uniformity of germination showing its effectiveness resulting highest germination percentage. Bhavyasree and Vinothini (2019) reported that seed factors along with the environmental factors are influencing the germination percentage, initial vigour of the seedling, plant population per unit area, yield and productivity.

4. CONCLUSIONS

The present study showed that black gram seeds soaked with 1.0 % KNO₃ recorded highest germination percentage (90 %), maximum root length of 9.5 cm along with comparatively high shoot length. Vigour index was also high when treating with 1.0 % KNO₃. Therefore, it can be concluded that for best germination percentage of black gram, 1.0 % KNO₃ could

be recommended for dormancy breaking treatment for black gram seeds.

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Figure 1: Effect of different concentrations of KNO₃ on seed germination

Figure 2: Comparison of root length on different treatments of KNO₃

Figure 3: Comparison of shoot length on different treatments of KNO₃

Figure 4: Effect of different concentrations of KNO₃ on vigour index