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EFFECT OF SEED PRIMING ON VARIOUS ROOTSTOCK OF CITRUS SPECIES

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ABSTRACT

Citrus fruits have a prominent place among the people and extensively grown in tropical and sub-tropical regions. In recent times the rootstock got the vast importance in citrus cultivation. Root stocks effect on the vigour, longevity, precocity, productivity, resistance or tolerance to diseases and pests and the quality of citrus fruits. There are many rootstocks which are used in the different parts of the world. Mostly common rootstocks are rough lemon (*Citrus jambhiri*) and rangpur lime (*Citrus limonia Osbeck*) in central zone of India. The percentage and rate of seed germination is very less in citrus species. In present investigation experiment was conducted in complete Randomized Block design with four replication under net house and were taken two citrus root stock (Rough lemon and Rangpur lime) and seed priming with water, Ga3 and cow urine 20 %. Maximum percentage of seed germination(85.09%), was observed under seeds which were priming by GA_3 @ 200 ppm followed by Cow urine @ 20% (78.75 %) while the minimum seed germination (54.43%) was recorded in seed priming by water (70.98%).Maximum seedling height, dry and fresh weight of seedling, number of leaves, survival percent and minimum day taken to germination, minimum days taken to first germination was also observed in rough lemon seed priming with GA3 200 ppm followed by cow urine 20 %.

Key words: Seed priming, GA_3, cow urine and Rough lemon

Introduction

Citrus fruits have a prominent place among the people and extensively grown in tropical and sub-tropical regions. In recent times the rootstock got the vast importance in citrus cultivation. Root stocks effect on the vigour, longevity, precocity, productivity, resistance or tolerance to diseases and pests and the quality of citrus fruits. There are many rootstocks which are used in the different parts of the world. Mostly common rootstocks are rough lemon (*Citrus jambhiri*) and rangpur lime (*Citrus limonia Osbeck*) in central zone of India.

The percentage and rate of seed germination is very less in citrus species. Rough lemon is the most widely used rootstock in the world. This stock is sensitive to cold. It has good adaptability to light sandy soils. It is not suitable for wet soils and poorly drained soils. It is more tolerant to salts than sweet oranges. *Rangpur Lime* (*Citrus limonia*) rootstock are vigorous and prolific with quality produce. It makes a good union with a number of citrus species like sweet oranges, mandarins and pummelos. It is highly resistant to tristeza and performs well in heavy soils. It is susceptible to exocortis. Some of its strains seem to be susceptible to phytophthora.

Seed priming is a pre-sowing seed treatment that allows controlled hydration of seeds to imbibe water and go through the first stage of germination but does not allow radical protrusion through the seed coat (McDonald, 2000). Seed germination is a complex physiological process which is mainly depends on environmental signals such as moisture, temperature, humidity, light, nitrate etc. While, poor seed germination is the major limiting factor of some of the important fruit crops including Rough Lemon and Rangpur Lime. It has been postulated that seed coat (testa) of many fruit species contains considerable amount of germination inhibitor viz., benzoic acid,

cinnamic acid, coumarin, naringenin, jasmonic and abscisic acid (ABA), which prevent their germination. However, the seed germination percentage of many fruit crops is very poor as well as late germination occurs. Slow seedlings growth bound to use as rootstocks. Several studies have been indicated that seed priming will improve the germination and subsequent growth of seedlings in many fruits species. Therefore, pre-treating seeds of fruit crops is very important and can be done either by physical method such as scarification or by soaking in chemicals, growth regulators water, organic substance like cow urine, cow dung slurry etc. (Choudhary *et al*., 2023).

Cow urine may bring a breakthrough in the present context as it is free of cost and easily available. Cow urine contains nitrogen, sulphur, ammonia, copper, iron, urea, uric acid, phosphate, sodium, potassium, manganese, carbolic calcium, salt, vitamins, lactose, enzyme, water, creatinin, aurum hydroxide etc (Dongre, *et al*., 2014). Seed priming in GA_3 200 ppm with Rough lemon seeds significantly influenced the germination parameters like germination percent.survival percent of seedlings, height of seedling, number of leaves/seedling and seedling vigour etc.

Material and Methods

The experiment was carried out at Zonal Agricultural Research Station, Chhindwara (M.P.) India under Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. The experimental was consisted in Completely Randomized Design with four replication. Treatments include seed priming (GA_3 200 ppm, cow urine 20% & control) and rootstock (rough lemon & rangpur lime) with six treatments combination i.e. R1P1 - Rough lemon seed priming with water, R1P2 -Rough lemon seed priming with GA_3 200 ppm, R1P3 -Rough lemon seed priming with cow urine 20%, R2P1 - Rangpur lime seed priming with water, R2P2 - Rangpur lime seed priming with GA_3 200 ppm and R2P3 - Rangpur lime seed priming with cow urine 20%. The normal, healthy and uniform sized 100 seeds, each of rough lemon and Rangpur lime were selected separately for six treatments.Observations were recorded on germination parameters i.e. germination percent, days taken to first germination, survival percent of seedlings, seedling height, number of leaves/seedling and days taken to first germination, at 60 days after sowing influenced by the seed priming in different rootstock.

Collection of fruits and seed extraction

Fully ripened, uniform sized and true to type fruits were collected from genuine and healthy rough lemon and rangpur lime tree from mother block of ZARS, Chhindwara. Subsequently fruits are cut into two pieces and seeds were extracted carefully, washed with clean water and spread in shade for 3-4 hours.

Preparation of Seed priming solution

The priming of seeds for each treatment was carried out for 3 hours. Seeds soaked with distilled water were considered as control. For making of 200 ppm GA_3 solution, 200 mg GA_3 weighed by the help of electronic balance and dissolved ethyl alcohol 10 ml in beakers. The distilled water was added to make up the volume equal to one liter to obtain desired concentrations of solutions. For making of 20 % cow urine taken 20 ml cow urine and added it in 100 ml water and thoroughly mixed it for solution. Fresh one liter cow urine is collected from Desi (indigenous) breed cow, in the morning from the cattle shade.

Seed priming

The normal, healthy and uniform sized 100 seeds, each of rough lemon and Rangpur lime were selected separately for six treatments. The concentrations of GA_3 200 ppm, cow urine 20% and distilled water 100 ml solution of each concentration was taken in 100 ml beaker and seeds were primed thoroughly.

Sowing of treated seeds

The treated seeds of both rootstocks (rough lemon and rangpur lime) were sown separately on raised bed by keeping the distance of 10 cm row to row and 5 cm plant to plant in plastic tray. Randomization was followed for treatment distribution within replication. Each treatment contained 150 seeds and 25 seeds were placed replication wise. After sowing the intercultural operations like regular watering, weeding and plant protection measures were followed properly. Drenching of copper fungicide (1.0%) was taken twice for control of damping off disease during the early period of investigation.

Germination (%)

The germination count was taken 10 days after sowing at an interval of 5 days. The seeds germinated were counted till completion of germination and the rate and percentage of seed germination was calculated by the following formula.

$$\text{Germination (\%)} = \frac{\text{Total no. of seeds germinated}}{\text{Total no. of seeds sown}} \times 100$$

Days taken to first germination:

The days taken to seed germination were recorded in days from date of seed sowing to first emergence of seedling.

Survival of seedling (%) at 60 DAS

The survival percentage of each treatment was recorded at 180 days after seed sowing. The survival percentage was calculated by using formula as given below:

$$\text{Survival}\,(\%) = \frac{\text{No. of survived seedlings}}{\text{Total no. of seedlings}} \times 100$$

Height of seedling (cm) at 60 DAS

The seedling height was recorded at 60 days after sowing. The length from the collar region to the tip of the shoot apex was measured. The height of ten plants in each treatment was measured in centimeters with the help of meter scale and the average value was reported.

Number of leaves at 60 DAS

The Number of leaves of ten plants in each treatment was counted at 60 DAS and the average value was reported.

Result and Discussion

The results of the present investigation show that significantly influenced the different germination parameters by seed priming and observed the maximum germination percent (87.56%), survival percent of seedlings (81.53 %), height of seedling (8.26 cm), maximum number of leaves/seedling (7.10), and minimum days taken to first germination (14.30) was recorded under seed priming with GA_3 @ 200 ppm followed by rangpur lime seed treated with GA_3.

The promoting of germination may be due to the antagonistic effect of GA_3 against influence of inhibitors (Brain and Hemming, 1958 and Wareing *et al*., 1968) and endogenous gibberellin increased by soaking (Mathur *et al*., 1971). Additionally, GA_3 participates in stimulation of protein synthesis which causes production of mRNA thereby the DNA replication is increased and analysis of seed endospermic materials are induced (Lahuti *et al*., 2003). The hormone of GA_3 induces different emergence processes in the seed such as absorption of growth inhibitors and initiation of enzymes which is essential for seed germination.

Seed priming with gibberellic acid exhibited significant effect on seedling survival percent and found maximum survival percent of seedling at 60 days after sowing. GA_3 might have enhanced the early germination and fast growth of seedling by cell multiplication and cell elongation subject to the enhanced seedling growth resulting maximum percent of seedling survival. The results found in present investigation are in conformity with the results of Parmer *et al*. (2019) in acid lime.

The enhancement in seedling height under GA_3 treatment may have occurred due to increased osmotic uptake of nutrients by this hormone which caused cell elongation and enhancement of seedling height (Shanmugavelu, 1966).

The increase in the number of leaves per seedling in GA_3 possibly due to the induced cell division and cell growth by the movement of GA_3 to the shoot apex which causes in increase of the young leaves (Salisbury and Ross, 1988). This also helps in invigoration of physiological process of plant and stimulatory effect of chemicals to form new leaves at faster rate as suggested by Shaban (2010).

Rough lemon is the quickest growing and high vigour of all common rootstocks. Due to fast and early germination character of rough lemon gives maximum germination percent and take minimum days for germination of all seeds(Choudhary *et al*., 2022). Gibberellins are well known for inter nodal cell elongation and higher accumulation of photosynthesis through the improved rate of photosynthesis by GA_3 thereby leading the increase in most of the germination and growth parameter. After germination seedling growth quickly and attain maximum height. Plant height is assumed to be a controlled character genetically (Choudhary *et al*., 2023).

Table 1 : Effect of seed priming on seed germination (%), days taken to first germination, survival percent of seedlings, seedling height and number of leaves/ seedling.

Treat. Symbol	Treatments detail	Seed germination (%)	Days taken to first germination	Survival (%) of seedlings	Seedling height	Number of leaves/ seedling
R_1P_1	Rough lemon + Distilled water	74.32	20.66	58.98	5.75	5.25
R_1P_2	Rough lemon + GA_3 200 ppm	87.56	14.30	81.53	8.26	7.10
R_1P_3	Rough lemon + cow urine 20%	81.73	17.21	74.70	7.87	6.34
R_2P_1	Rangpur lime + Distilledwater	68.64	22.11	54.39	5.54	5.16
R_2P_2	Rangpur lime+ GA_3 200 ppm	83.64	14.79	76.83	8.01	6.94
R_2P_3	Rangpur lime + cow urine 20%	76.79	17.88	69.78	7.69	6.28
SE(m)±		0.489	0.255	0.473	0.081	0.050
CD 5%		1.465	0.763	1.416	0.244	0.150
C.V.		1.243	2.861	1.364	2.266	1.626

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