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Effect of Seed Priming with GA_3 and KNO_3 on Nursery Raising of Ridge Gourd (*Luffa acutangula*) and Summer Squash (*Cucurbita pepo*)

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ABSTRACT

A study was conducted to examine the effect of seed priming with different chemicals on germination and nursery raising of Ridge Gourd (Luffa acutangula) and Summer Squash (Cucurbita pepo) at Agriculture Lab of D.A.V College, Abohar. The seeds of both ridge gourd and summer squash were treated with GA_3 (0.1% and 0.2%) and KNO_3 (0.3% and 0.4%) for 24 hrs at room temperature on 14th Feb, 2017. Untreated seeds of both ridge gourd and summer squash were used as control. After 24 hrs of priming, the seeds were surface washed with distilled water. 10 treated seeds of each treatment were then sown in germination tray filled with growing media (cocopeat) and 10 control seeds of both vegetables were sown in plastic cups containing cocopeat. Both treated and untreated (control) seeds were then allowed to grow in laboratory for 30 days. Priming with 0.2% GA_3 solution enhanced the germination initiation, percentage of germination, mean germination time and vigour index of ridge gourd and summer squash than unprimed seeds. Average seedling length was higher in 0.3% KNO_3 primed seeds than the other seeds.

Keywords: GA_3, KNO_3, Ridge gourd, Seed Priming, Summer squash.

I INTRODUCTION

Ridge gourd (*Luffa actangula)* is a subtropical annual vine vegetable which is monoecious having pistillate flowers in axil of flowers and staminate flowers in main raceme whereas some of these such as 'Satputa in Bihar' are hermaphrodite (Munshi *et al*, [1]). Summer squash (*Cucurbita pepo)* is locally known as chappan kaddoo and are annual herbs, monoecious, spreading or occasionally bushy with harsh bristles. Both vegetables belongs to cucurbitaceae family. Seed primiing is a pre-sowing treatment method that involves exposure of seeds to a low external water potential that limits hydration. This hydration is sufficient to permit pre-germinative metabolic events but insufficient to allow radicle protrusion through the seed coat (Nascimento, [2]). A high amount of water is needed for radicle to emerge out, therefore the priming process is ceased to prevent full germination from occurring. The primed seeds can then be dried and sown when ready. Seed

priming is a physiological method which helps in improving the performance of crop as well as provides faster and synchronized germination. This method therefore helps in increasing the percentage and uniformity of germination especially under unfavourable conditions (Farhoudi, [3]). Various seed priming techniques have been developed such as hydro-priming (water), priming with plant growth regulators (GA_3), osmopriming (PEG), halopriming (NaCl, KNO_3), solid matrix-priming (vermiculite), hormonal priming (ascorbate). Potassium nitrate (KNO_3) is the most widely used chemical for promoting germination. Nitrate (such as KNO_3) stimulates the germination of dormant seeds (Gashi *et al*, [4]). Seed priming with KNO_3 showed enhancement in seed germination, seedling emergence, vigour index in different vegetables crops. Gibberellic acid (also called Gibberellin A3, GA and GA_3) is a plant growth regulator found in plants and fungi. Its chemical formula is $C_{19}H_{22}O_6$. GA_3 was first identified in Japan in 1926 by scientist Kurosawa, as a metabolic by-product of the plant pathogen *Gibberella fujikuroi* (asexual stage *Fusarium heterosporum*) which causes foolish seedling (bakanae) disease of rice plants. Gibberellic acid is a pentacyclic diterpene acid that helps in promoting growth and elongation of cells. GA_3 promotes rapid stem growth by accelerating cell growth and cell division in subapical meristem which increases length of internodes, induces mitotic division in the leaves of some plants, increases seed germination rate and also reduce the apical dominance of auxins. Gibberellic acid is sometimes used in laboratory and greenhouse settings to trigger germination in seeds that would otherwise remain dormant (Riley, [5]). Therefore by using seed priming techniques the problems of farmers such as dormancy of seeds, delay in germination, non uniformity in germination, lower germination percentage, less vigour index can be solved. Thus this research will be very helpful to farmers in getting early and synchronized yield.

II MATERIALS AND METHODS

This research work was done to find the effect of halopriming and plant growth regulator priming on seed germination and early seedling growth of Ridge gourd (*Luffa acutangula*) and Summer squash (*Cucurbita pepo*). The seed treatments were consisted of control, growth regulator priming (0.1% GA_3 and 0.2% GA_3) and halopriming (0.3% KNO_3 and 0.4% KNO_3) for 24 hours at room temperature on 14-Feb-2017. After priming treatments, the seeds surface was washed thoroughly with distilled water. Then, seeds were sown in coco-peat medium in tray and glasses. 10 treated seeds of each treatment were placed in tray and 10 untreated seeds of each vegetable were placed in glasses for germination. The treated and untreated seeds were germinated under laboratory conditions and seed germination was recorded daily for up to 25-30 days.

Research was done to find the effect of GA_3 and KNO_3 on germination initiation, germination percentage, mean germination time, seedling length and vigour index. Germination initiation was observed by visual appearance i.e. no. of days from the date of sowing till germination. Germination percentage was calculated by following formula:

(1) Germination percentage: $\frac{\text{Total number of seeds germinated}}{\text{Total number of seeds used}} \times 100$

Mean Germination Time (MGT) was measured by using Ellis and Roberts (1981) equation:

(2) MGT: $\frac{\Sigma(Dn)}{\Sigma n}$

(D is the numbers of days and n is the number of seed germinated on day D)

Seedling length was measured with the help of thread and scale.

Vigour index was calculated by using following formula:

(3) Vigour Index: Seedling Length x Germination Percentage

III RESULTS AND DISCUSSIONS

3.1 Germination initiation

Priming of summer squash and ridge gourd seeds with GA_3 and KNO_3 resulted in their early germination. Data regarding germination initiation of both ridge gourd and summer squash has been presented in Table 4.1. From the table 4.1, it can be found that priming of ridge gourd seeds with GA_3 i.e. 0.1% and 0.2% GA_3 resulted in faster germination whereas there was no such difference observed in germination initiation when seeds were treated with 0.4% KNO_3 and control. Seeds of summer squash germinated a day earlier when treated with 0.2% GA_3 followed by 0.1% GA_3, 0.3% KNO_3 and 0.4% KNO_3. Maximum time to start germination was taken by unprimed seeds. The observation of this research is similar with that of Shahzad *et al* [6] who showed that priming of sponge gourd seeds with GA_3 reduced the time taken by seeds to geminate whereas control seeds took maximum time to start germination. Farooq *et al* [7] also found that primed seeds of late sown wheat resulted in faster germination than unprimed seeds.

3.2 Germination percentage

Germination percentage of both summer squash and ridge gourd increased when the seeds were primed with priming agents. From the data presented in table 4.2, It can be concluded that maximum germination percentage of ridge gourd seeds was observed with 0.2% GA_3 followed by 0.3% KNO_3 and 0.1% GA_3 whereas germination percentage of seeds of summer squash treated with 0.2% GA_3, 0.3% KNO_3 and 0.4% KNO_3 was found to be equal and in both cases germination percentage of control seeds was least. Nath and Deka [8] also gave similar results that maximum germination percentage was of seeds treated with 0.2% GA_3 and least percentage was of control seeds.

3.3 Mean Germination Time (MGT)

Seeds primed with GA_3 and KNO_3 germinated in lesser time than unprimed seeds. Table 4.3 shows the data recorded on the effect of seed priming on Mean Germination Time of ridge gourd and summer squash. It can be analyzed that seeds treated with GA_3 germinated in less time as compared to control and KNO_3 treatment in both ridge gourd and summer squash. In case of ridge gourd, seeds treated with 0.4% KNO_3 had taken maximum time to germinate whereas summer squash seeds of control treatment germinated in maximum time. Similar findings were obtained by Nascimento [2] that seed priming of muskmelon with 0.30 mol/L KNO_3 resulted in minimum mean germination time and maximum mean germination time was taken by unprimed seeds. Shahi-Gharahlar *et al* [9] resulted that mean germination time of seeds of summer squash was least when primed with priming agents such KNO_3 and maximum time to germinate was taken by control and PEG solution under non-saline conditions.

3.4 Seedling Length

The effect of seed priming on seedling length of ridge gourd and summer squash is presented in table 4.4. From the data, it was concluded that ridge gourd seeds primed with 0.3% KNO_3 produced seedlings of slightly more length in cm than control seeds and seeds primed with GA_3. Seedling length of summer squash was not much affected by priming treatment but there was slight increase in seedling length of KNO_3 treated seeds. Similar results were given by Ramzan *et al* [10] that maximum seedling length was of gladiolus seeds treated with 3% KNO_3 and smallest seedlings were of control gladiolus seeds. Pandey *et al* [11] also found that seed priming increased seedling length of cucumber seeds than unprimed seeds.

3.5 Vigour index

Seed priming with GA_3 and KNO_3 positively affected vigour index of both ridge gourd and summer squash. From the data given in table 4.5, it can be found that seed priming of both ridge gourd and summer squash with 0.2% GA_3 and 0.3% KNO_3 gave better results regarding seedling vigour index. Least vigour index was of control in case of ridge gourd and 0.1% GA_3 in case of summer squash. Similarly, Rahman *et al* [12] analyzed that maximum seedling vigour index was of ash gourd seeds treated with 0.4% KNO_3 which was much greater than control seeds i.e. 52.14% higher than control treatment. Also seed priming with 0.2% KNO_3 and 0.6% KNO_3 produced seedlings with higher seedling vigour index than control.

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IV OBSERVATIONS AND TABLES

Table 4.1: Effect of seed priming with GA_3 and KNO_3 on Germination initiation

	Chemical and Concentration				
Vegetables	0.1% GA_3	0.2% GA_3	0.3% KNO_3	0.4% KNO_3	Control
Ridge Gourd	4 D.A.S	4 D.A.S	6 D.A.S	7 D.A.S	7 D.A.S
Summer Squash	7 D.A.S	6 D.A.S	7 D.A.S	7 D.A.S	8 D.A.S

Table 4.2: Effect of seed priming with GA_3 and KNO_3 on Germination percentage

	Chemical and Concentration				
Vegetables	0.1% GA_3	0.2% GA_3	0.3% KNO_3	0.4% KNO_3	Control
Ridge Gourd	90%	100%	90%	80%	80%
Summer Squash	80%	90%	90%	90%	80%

Table 4.3: Effect of seed priming with GA_3 and KNO_3 on Mean Germination Time

	Chemical and Concentration				
Vegetables	0.1% GA_3	0.2% GA_3	0.3% KNO_3	0.4% KNO_3	Control
Ridge Gourd	6.80 days	6.10 days	7.40 days	8.90 days	8.40 days
Summer Squash	9.50 days	9.20 days	10.10 days	10.50 days	10.70 days

Table 4.4: Effect of seed priming with GA_3 and KNO_3 on Seedling Length

Vegetables	Chemical and Concentration				
	0.1% GA_3	0.2% GA_3	0.3% KNO_3	0.4% KNO_3	Control
Ridge Gourd	4.55 cm	5.08 cm	5.30 cm	4.88 cm	5.10 cm
Summer Squash	4.40 cm	4.52 cm	4.70 cm	4.50 cm	4.60 cm

Table 4.5: Effect of seed priming with GA_3 and KNO_3 on Vigour index

Vegetables	Chemical and Concentration				
	0.1% GA_3	0.2% GA_3	0.3% KNO_3	0.4% KNO_3	Control
Ridge Gourd	409.5	508.0	477.0	390.4	408.0
Summer Squash	352.0	406.8	423.0	405.0	368.0

V CONCLUSION

From the investigation done to study the effect of seed priming with GA_3 and KNO_3 on ridge gourd and summer squash seeds, a conclusion can be made that priming of seeds with 0.2% GA_3 results in early germination, more germination percentage, lesser mean germination time and better vigour index. Also seed priming with 0.3% KNO_3 helps in increasing the seedling length of both ridge gourd and summer squash than unprimed seeds. Thus it can be concluded that priming with 0.2% GA_3 and 0.3% KNO_3 will result in better germination and seedling growth of both ridge gourd and summer squash which will solve some of the problems faced by modern day farmers.

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