RESEARCH ARTICLE

EFFECT OF COW URINE AND GA_3 ON GERMINATION OF SEEDS AND SEEDLING GROWTH OF KARONDA (*CARISSA CARANDAS* L.) UNDER POLYHOUSE CONDITION

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Abstract: The present investigation entitled "Effect of cow urine and GA_3 on germination of seeds and seedling growth of karonda (*carissa carandas* L.)" was conducted at under poly house condition during the year 2019- 20 at the Krishi Vigyan Kendra, College of Agriculture, Rewa (M.P.) It was conducted to study the individual effect as well as combined effect of seed soaking duration, cow urine and GA_3 concentration on seed germination and seedling growth of karonda. Hence, pre-sowing treatments with cow urine and plant growth regulators (GA_3) have a significantly role on the seed germination. The experiment was laid out in randomised block design with 7 treatments (T_1 - control, T_2 - GA_3 100 ppm for 12 hours, T_3 – GA_3 100 ppm for 24 hours, T_4 – GA_3 100 ppm for 36 hours, T_5 - cow urine 25% for 12 hours, T_6 – cow urine 25% for 24 hours and T_7 – cow urine 25% for 36 hours). The treatment was replicated thrice. All the seed and treatments showed better germination and growth when compared to control. Among various combination, the effect of seed treatment with GA_3 100 ppm 24 hours were more superior over the other combination with highest seed germination (6.55), complete germination (20.32), germination percentage (76.66%). Growth parameters at 30, 60, 90 and 120 DAS with seedling height (3.22, 6.21, 8.94 and 9.73 cm), diameter of shoot (0.63, 2.23, 3.04 and 3.23), number of leaves/ seedling (3.86, 10.66, 17.34 and 20.53/seedling), leaf area (2.09 cm^2), fresh weight of leaves (1.22 g), dry weight of leaves (0.54 g), length of roots (20.67 cm), fresh weight of roots (0.64 g), dry weight of roots (0.30 g), seedling vigour index (1581.80 cm).

Keywords: Karonda, Seeds, Treatment, Germination, Growth

INTRODUCTION

Karonda (*Carissa carandas* L.) is native to India and grows wild in Maharashtra, Rajasthan, Uttar Pradesh, West Bengal, Madhya Pradesh, Bihar and Andhra pradesh in wild form. Mount Abu region of Rajsthan and Rajgarh region of Madhya Pradesh have its natural variability. It is popularly known as "Bengal currant" or "Christ's Thorn". It belongs to family Apocynaceae with chromosome number 2n = 22. Karonda is an important minor indigenous under exploited fruit crop of India. It has recently attained importance as an arid zone horticulture crop because of its hardy nature and its nutritious fruits.

Flowers of karonda are white, fragrant, tubular, regular, bisexual, complete, epigynous and solitary or in cymose clusters. Sepals 4-6, green in colour, almost free at the base, imbricate, persistent and are ovate in shape. The fruit is a berry, formed in clusters of 3-10 fruits and globose to broad ovoid in shape. Young fruits are pinkish, white at maturity, fruit colour white, green and pinkish red depending on the genotype. Seed 3-5 per fruit, blackish brown, flat, elliptical and light in weight. Flowering starts during January-February and fruits mature in May- June.

In India, the mature fruit is harvested for Indian pickles. It contains pectin and accordingly is a useful ingredient in chutney. Ripe fruits exude white latex when severed from the branch. The unripe fruits of karonda are medicinally used as an astringent. The ripe fruit is sweet, cooling, appeaser and antiscorbutic and is useful in controlling burning sensation, skin diseases, scabies, pruritus and particularly suitable for tarts and puddings. Fruits are generally harvested at immature stage for vegetable purpose, while fully ripen fruits are consumed fresh or processed (Malik et al., 2010). Karonda fruit is a rich source of iron and dried fruits (39.10mg/ 100g) of iron and contains a fair amount of vitamin C. Therefore, it is very useful for cure of anemia and has antiscorbutic properties.

It is sometimes grown as an ornamental plant due to its beautiful cherry like fruits. Karonda is best suited as a live protective fence due to the presence of auxiliary spines and formation of profuse leaves on crowded branches. It has excellent potential to be used for horticultural plantations in marginal and wastelands, owing to its hardy and xerophytic nature with wide adaptability to saline sodic soils with pH up to 10 (Bankar et al, 1994 and Chundawat., 1995).

Many horticultural crops including karonda produce recalcitrant seeds which lose their viability when dried below the threshold value. Most recalcitrant seed can not tolerate moisture below 25 percent and some species are also sensitive to chilling temperature. Karonda is commonly propagated by seed and fresh seed are sown for raising seedlings in the month of August and September.

Pre-sowing treatments with cow urine and plant growth regulator like Gibberellic Acid (GA_3) etc. have a significant role on the germination percentage, emergence, seedling height, number of leaves and roots in karonda and other crops. Soaking seeds in aqueous solutions of cow urine and plant growth regulators for (GA_3) 12, 24 and 36 hours has been found to induce early germination, enhance germination percentage and promote seedling growth in fruit crops like Mango, custard apple, citrus,

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karonda etc.

The use of organic waste in proper concentration with scarification may regulate growth behaviour in many fruit crops and pre- sowing treatments of organic waste could lead to increases seed germination and enhancement of seedling growth.

Cow urine contains Iron, urea, uric acid, estrogen and progesterone which affect the inhibitory response to seed germination, shoot growth and seedling vigour (Dilrukshi, 2009). Gibberellic acid (GA_3) is used for weakening of the seed coat so that the radicle of the seedling can break through the seed coat. Gibberellins also help in enhancing the availability of reserved mineral elements which promote the germination process.

MATERIALS AND METHODS

Experimental site

The present investigation was carried in polyhouse at (KVK), College of Agriculture, Rewa (M.P.) during the rainy season (2019 - 2020). The experiment was conducted during September 2019 to January 2020. The soil of the experimental site was clay loam in texture and field was well drained, leveled and uniform having very gentle slope. Rewa is situated in the North Eastern part of Madhya Pradesh at latitude 24031 N, longitude 81015 E and altitude 365.7 meter above the mean sea level.

Seed material:

The seeds of karonda (*Carissa carandus* L.) were obtained from farm research station of college of agriculture, Kuthuliya, Rewa District, Madhya Pradesh, India.

Preparation of cow urine solutions:

25% fresh cow urine was measured with measuring cylinder and poured into 100 ml beaker each.

Preparations of Growth Regulator Solutions:

The stock solution (100 ppm) of GA_3 was prepared by dissolving 0.1 gm of GA_3 in 10 ml of methanol and after making a volume of one liter by adding pure distilled water.

Seed treatment:

Freshly harvested seeds of karonda were soaked in cow urine 25% and GA_3 100 ppm of different concentration for a period of 12 hours, 24 hours and 36 hours and sown in polybags under the poly house.

Filling of polybags:

Polybags of 200 gauge thickness having length of 6 cm and diameter of 3 cm were used. Bags were filled as per treatment.

Seed sowing:

Treated seeds of karonda were sown in polythene bags of 6 x 3 cm size filled. One seed per poly bag was sown at 2-3 cm depth.

Seed vigour parameters

Initiation of germination:

The days taken to initiate germination in each treatment after sowing were observed and recorded.

Number of days taken to start germination:

Seeds used for testing the germination were observed daily and recorded the data of initiation of germination of each treatment separately.

Number of days taken to complete germination:

The number of days was counted from starting of germination in 15 days intervals till the germination was completed.

Germination percentage:

From the date of start of germination, germinated seed were counted daily and finally the percentage of germination was calculated.

$$\text{Germination } \% = \frac{\text{Total No. of germinated seed of a treatment}}{\text{Total No. of seed sown in the treatment}} \times 100$$

Shoot Observations:-

Seedling height (cm):

Five plants were randomly selected for recording the shoot length of seedling. Plant height was measured in cm after complete germination at 30 days interval with the help of centimeter scale and recorded at 30, 60, 90 and 120 DAS in each treatment. The height of the seedlings of Karonda was taken from ground level to the base of the tip of fully opened leaf.

Diameter of shoot (mm):

The diameter of the stem of the seedlings was measured with the help of Vernier calliper at 30, 60, 90 and 120 DAS just above the ground surface. It was measured in mm after 30 days interval in each treatment.

Number of leaves per seedling:

The total number of leaves was counted from five randomly selected plants was counted in 30 days interval in each treatment at 30, 60, 90 and 120 DAS the average of number of leaves was computed.

Fresh weight of leaves per plant:

The fresh weight was taken from five randomly selected plants from each treatment. The leaves were immediately weighed. The total leaves of a plant were put on at instead after Electrical Weighing balance weight of total leaves per plant was recorded and mean fresh weight of leaves of a plant was calculated.

Dry weight of leaves per plant:

The fresh weight of leaves was recorded and then the leaves were kept in oven to dry in appropriate temperature (60^0C) for 12 hours for the removal of moisture content from the leaves. The dry weight of leaves was recorded with the help of an electrical balance. After dryness of leaves average of weight of leaves per plant was calculated and expressed in g.

Seedling Vigour Index:

The data were compiled successfully and S.V.I. was calculated and average root length expressed in cm^2.

S.V.I. = Total % of germinated seeds of treatment X Root length.

Leaf Area:

Leaf area of selected five seedlings at the time of transplanting (120 DAS) was measured with the leaf

area meter and the average leaf area per sq. cm was observed.

Root observations:-

Root length:

The length of roots of five randomly selected plants of each treatment at 30, 60, 90 and 120 DAS were recorded with the help of centimeter scale. The length of roots was measured from the base up to tip.

Fresh weight of roots per seedling:

Weight of detached roots from five selected plants was taken with the help of an electrical balance and average fresh weight per plant was calculated.

Dry weight of roots per plant:

The roots of fresh weight were recorded and then roots were kept in the oven to dry in the appropriate temperature (60^0C) for 12 hours for the removal of moisture content from the roots. The dry weight of roots was recorded with the help of an electrical balance after dryness of roots and average dry weight per plant was calculated.

RESULTS AND DISCUSSION

Seed vigour parameters:

Start germination:

The results on the effect of cow urine and GA_3 on initiation of germination of karonda seeds is shown in Table 1. Earliest germination (6.55 days) was recorded in seeds treated with GA_3 100 ppm for 24 hours. Soaking of tamarind seeds in 10 percent cow urine or cow dung solution for 24 hours increased the germination and vigour index as compared to that of untreated seeds (Shankaranarayanan *et al*.,1994).

Complete germination:

The results on the effect of cow urine and GA_3 on intiation of germination of karonda seeds is shown in Table 1. Minimum days taken to complete germination (20.32) were recorded in seeds treated with GA_3 100 ppm for 24 hours. 10 percent cow urine 24 hours soaking treatment is effective for breaking dormancy and increasing germination and seedling growth tamarind (Parameswari *et al*., 2001).

Germination percentage:

The results on the effect of cow urine and GA_3 on initiation of germination of karonda seeds is shown in Table 1. Maximum germination percentage (76.66%) was recorded in seeds treated with GA_3 100 ppm for 24 hours.

Growth parameters

Seedling height (cm):

The results on the effect of cow urine and GA_3 on seedling height at various intervals (30,60, 90 and 120 DAS) is represented in Table 2. The maximum seedling height (3.22, 6.21, 8.94 and 9.73) was obtained in seeds treated with GA_3 100 ppm for 24 hours.

Diameter of shoot (mm):

The results on the effect of cow urine and GA_3 on shoot diameter at various intervals (30, 60, 90 and 120 DAS) is represented in Table 2. The maximum shoot diameter (0.63, 2.23, 3.04 and 3.23) was obtained in seeds treated with GA_3 100 ppm for 24 hours.

Number of leaves per seedling:

The results on the effect of cow urine and GA_3 on number of leaves per seedling at various intervals (30, 60, 90 and 120 DAS) is represented in Table 2. The maximum number of leaves (3.86, 10.66, 17.34 and 20.53) was obtained in seeds treated with GA_3 100 ppm for 24 hours.

Fresh weight of leaves:

The results on the effect of cow urine and GA_3 on fresh weight of leaves is maximum (1.22 g) were obtained in seeds treated with GA_3 100 ppm for 24 hours.

Dry weight of leaves:

The results on the effect of cow urine and GA_3 on fresh weight of leaves is maximum (1.22 g) were obtained in seeds treated with GA_3 100 ppm for 24 hours.

Leaf area:

The results on the effect of cow urine and GA_3 on leaf area is maximum (2.09 cm^2) were obtained in seeds treated with GA_3 100 ppm for 24 hours.

Length of roots:

The result regarding the effect of cow urine and GA_3 on length of roots of karonda seeds at 120 DAS is represented in Table 3. The longest root length (20.67) was recorded in seeds treated GA_3 100 ppm for 24 hours.

Fresh weight of roots (g):

The result regarding the effect of cow urine and GA_3 on fresh weight of roots of karonda seeds at 120 DAS is represented in Table 3. The maximum fresh weight of roots (0.64) was recorded in seeds treated GA_3 100 ppm for 24 hours.

Fresh weight of roots (g):

The result regarding the effect of cow urine and GA_3 on dry weight of roots of karonda seeds at 120 DAS is represented in Table 3. The maximum dry weight of roots (0.64) was recorded in seeds treated GA_3 100 ppm for 24 hours.

Seedling vigour index:-

The result regarding the effect of cow urine and GA_3 on of Seedling vigour index karonda seeds at 120 DAS is represented in Table 3. The maximum seedling vigour index (1581.80) was recorded in seeds treated GA_3 100 ppm for 24 hours.

Table 1. Effect of cow urine and GA_3 on seed vigour and growth parameters

Treatment	Days taken to start germination	Complete germination	Germination percentage
T_1 – Control	9.91	18.10	50.00
T_2 - cow urine 25% for 12 hours	8.69	18.87	60.00
T_3 - cow urine 25% for 12 hours	8.59	18.90	63.33
T_4 - cow urine 25% for 12 hours	7.54	18.39	56.66
T_5 - GA_3 100 ppm for 24 hours	6.84	20.07	73.37
T_6 - GA_3 100 ppm for 24 hours	6.55	20.32	76.66
T_7 - GA_3 100 ppm for 24 hours	7.16	19.29	70.00
S.Em±	0.45	0.79	4.21
C.D. at 5%	1.32	2.31	12.29

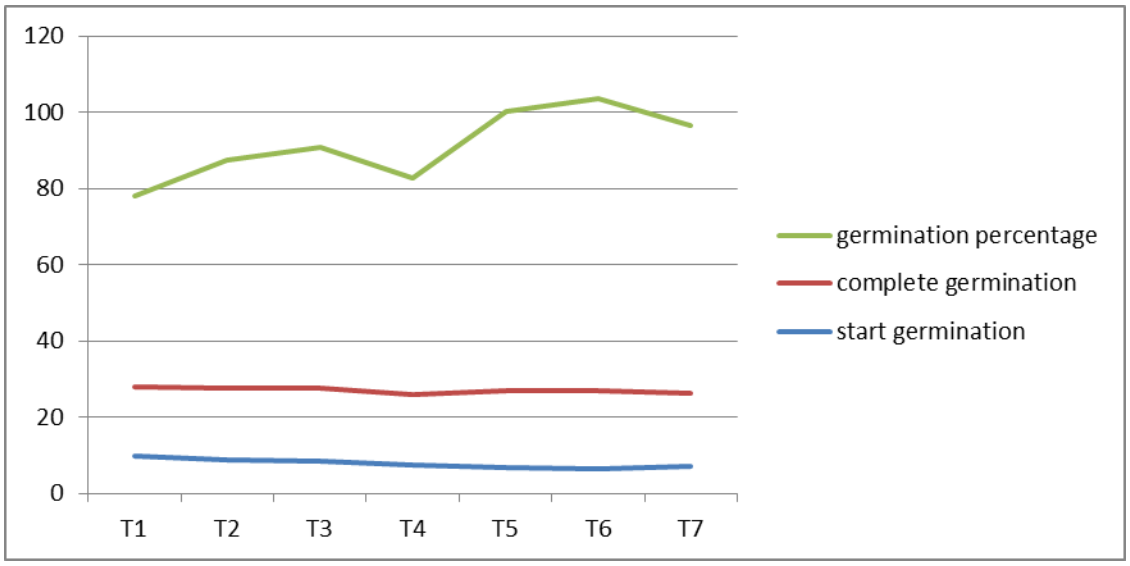

Fig 1. Germination of seeds of karonda as influenced by cow urine and GA_3

Table 2. Effect of cow urine and GA_3 on growth parameters at different intervals

Treatment	Plant height				Diameter of shoot				Number of leaves				Fresh weight of leaves	Dry weight of leaves	Leaf area
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS			
T_1 – Control	2.43	3.16	6.12	7.27	0.48	1.03	1.71	2.13	2.43	7.53	10.93	13.66	0.67	0.30	1.19
T_2 - cow urine 25% for 12 hours	2.62	4.97	7.32	7.87	0.53	1.61	2.27	2.78	2.62	8.26	14.40	16.87	0.91	0.37	1.73
T_3 - cow urine 25% for 12 hours	2.76	5.05	7.47	8.52	0.55	1.69	2.33	2.82	2.76	8.53	15.15	17.33	0.94	0.40	1.76
T_4 - cow urine 25% for 12 hours	2.55	4.87	7.17	7.39	0.52	1.53	2.12	2.61	2.55	8.15	14.34	16.20	0.84	0.35	1.71
T_5 - GA_3 100 ppm for 24 hours	2.93	5.40	8.47	9.39	0.60	2.20	2.88	3.16	3.74	10.53	16.75	19.06	1.18	0.48	2.05
T_6 - GA_3 100 ppm for 24 hours	3.22	6.21	8.94	9.73	0.63	2.23	3.04	3.23	3.86	10.66	17.34	20.53	1.22	0.54	2.09

T_7 - GA_3 100 ppm for 24 hours	2.88	5.14	8.11	9.22	0.58	1.98	2.77	3.09	3.15	10.46	16.40	18.80	1.12	0.41	1.98
S.Em±	0.30	0.43	0.38	0.33	0.01	0.25	0.19	0.17	0.26	0.65	0.59	1.28	0.15	0.12	0.16
C.D. at 5%	0.87	1.26	1.12	0.96	0.03	0.72	0.57	0.50	0.75	1.89	1.72	3.72	0.44	0.35	0.47

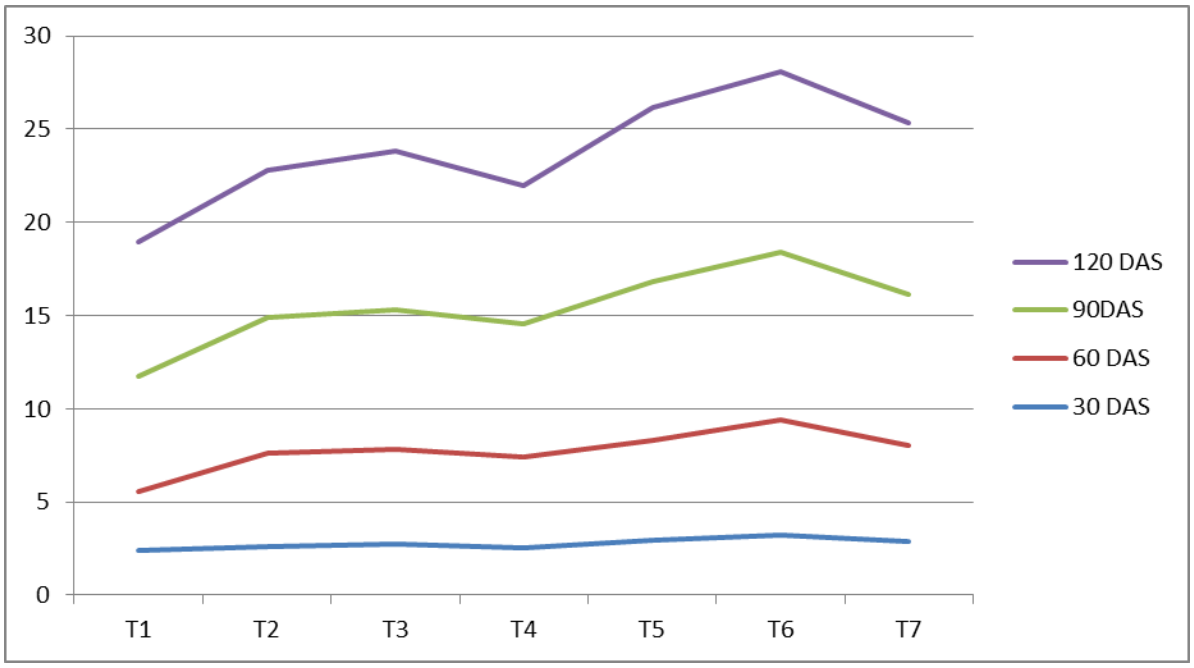

Fig. 2. Effect of cow urine and GA_3 on plant height (cm) at 30 DAS, 60 DAS, 90 DAS and 120 DAS

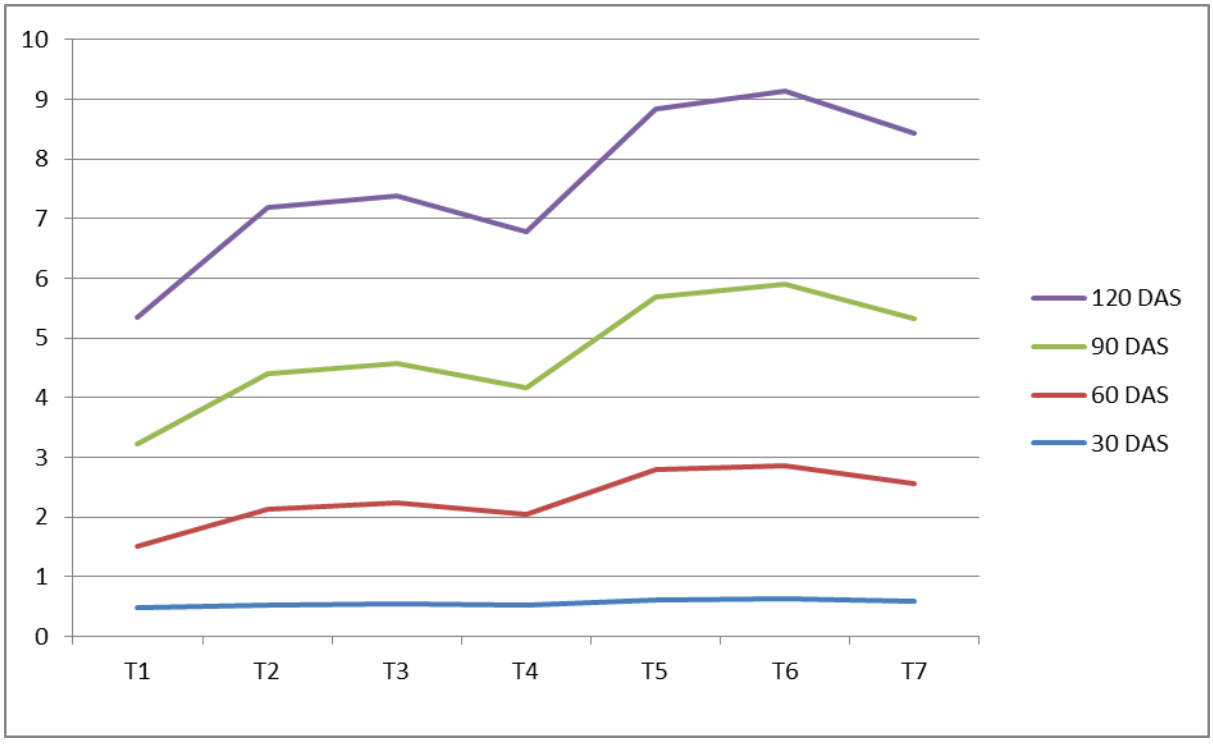

Fig. 3. Effect of cow urine and GA_3 on diameter of shoot (cm) at 30 DAS, 60 DAS, 90 DAS and 120 DAS

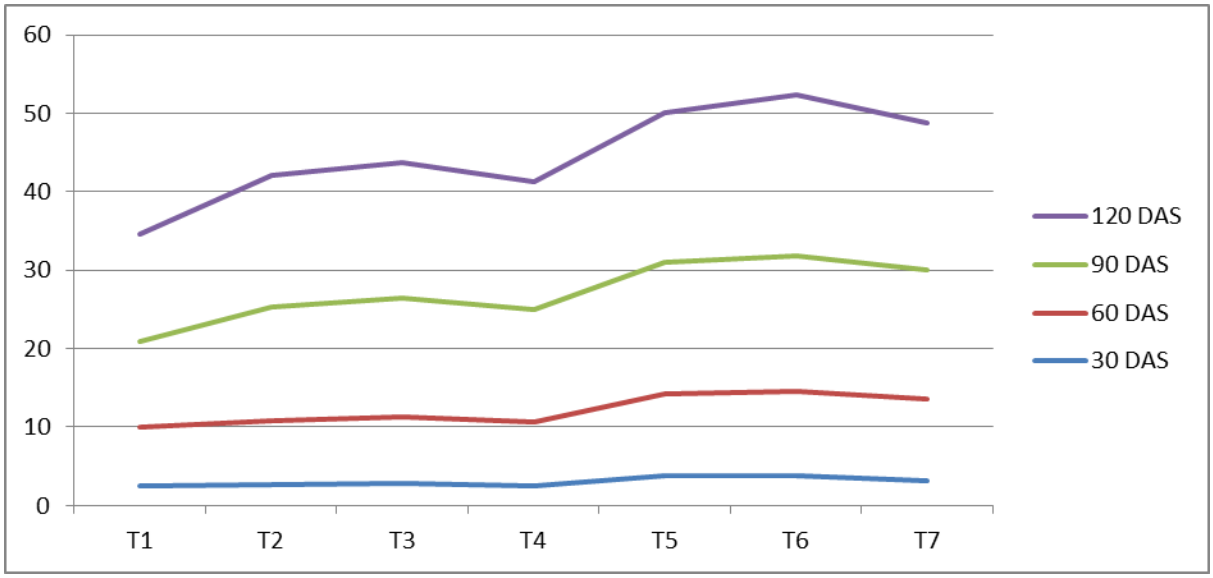

Fig. 4. Effect of cow urine and GA_3 on number of leaves (cm) at 30 DAS, 60 DAS, 90 DAS and 120 DAS

Fig. 5. Effect of cow urine and GA_3 on fresh weight and dry weight of leaves (g) and leaf area (cm^2) at 30 DAS, 60 DAS, 90 DAS and 120 DAS

Table 3. Effect of cow urine and GA_3 on root parameters at different intervals

Treatment	Length of roots	Fresh weight of roots	Dry weight of roots	Seedling vigour index
T_1 – Control	11.29	0.30	o.13	564.50
T_2 - cow urine 25% for 12 hours	16.29	0.48	0.18	1013.03
T_3 - cow urine 25% for 12 hours	17.09	0.49	0.22	1080.73
T_4 - cow urine 25% for 12 hours	16.36	0.44	0.17	922.26
T_5 - GA_3 100 ppm for 24 hours	20.15	0.59	0.27	1478.60
T_6 - GA_3 100 ppm for 24 hours	20.67	0.64	0.30	1581.80

T_7 - GA_3 100 ppm for 24 hours	19.00	0.54	0.26	1332.73
S.Em±	0.52	0.10	0.02	72.94
C.D. at 5%	1.51	0.30	0.05	212.88

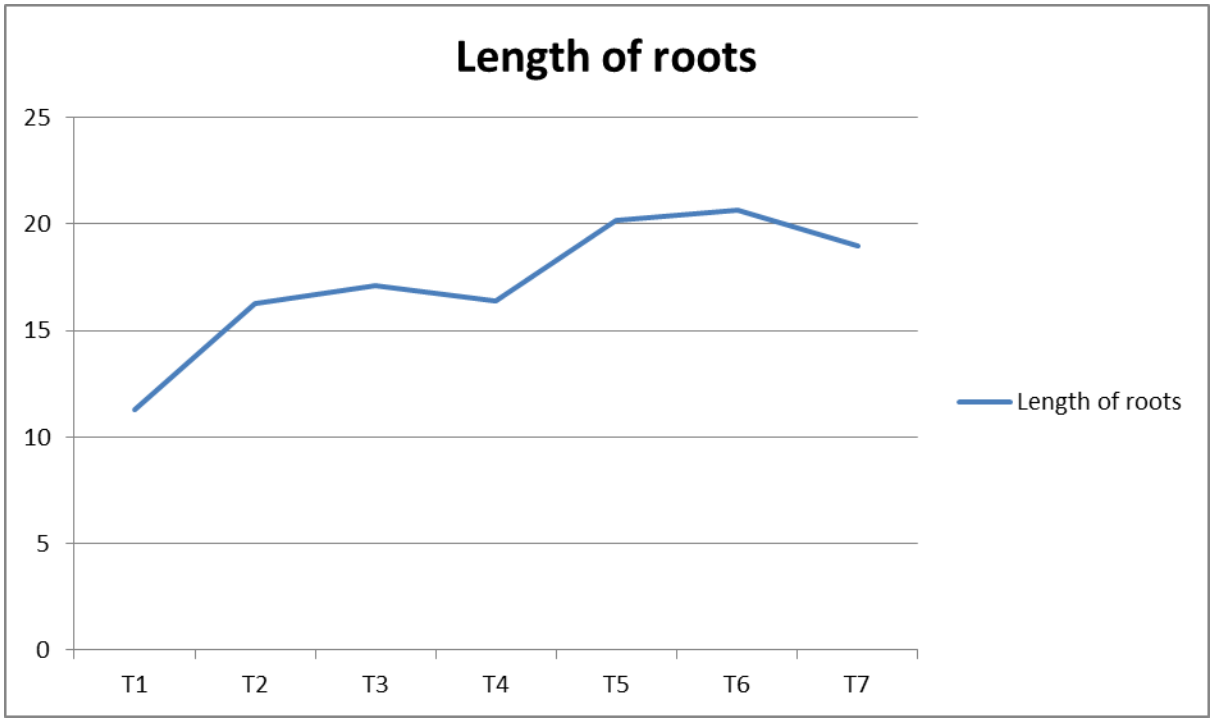

Fig. 6. Length of roots of karonda as influenced by cow urine and (GA_3)

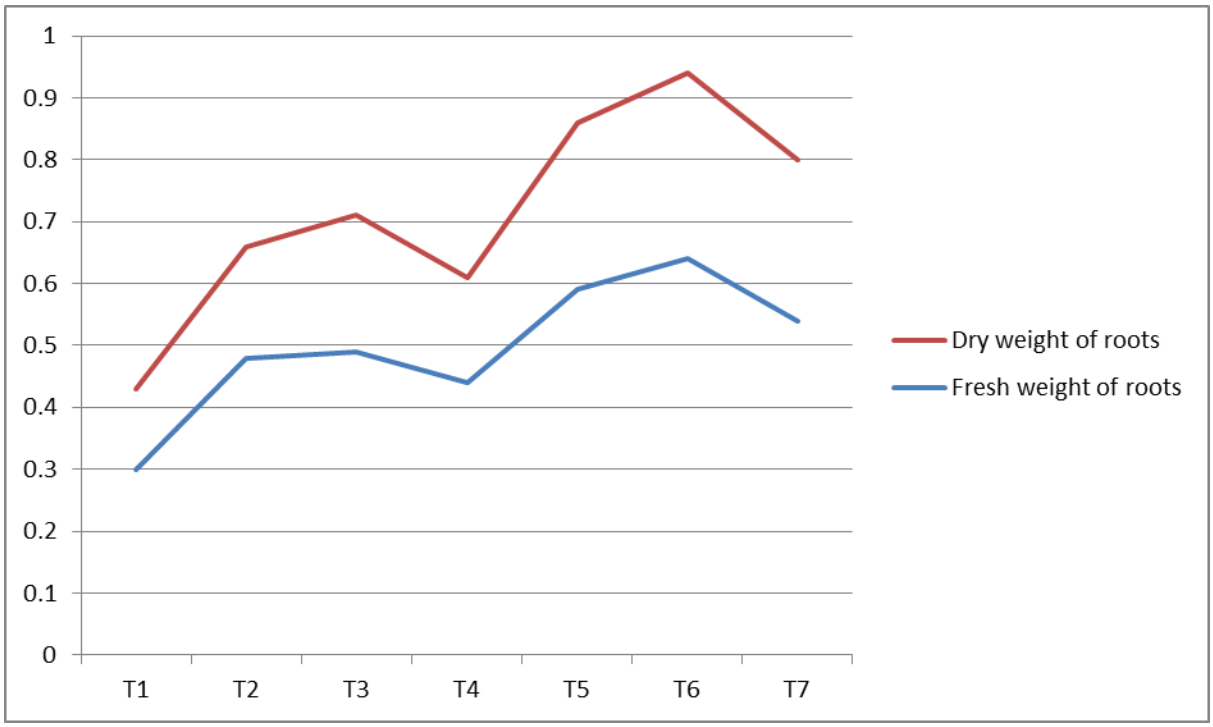

Fig. 7. Fresh weight and dry weight of roots of karonda as influenced by cow urine and (GA_3)

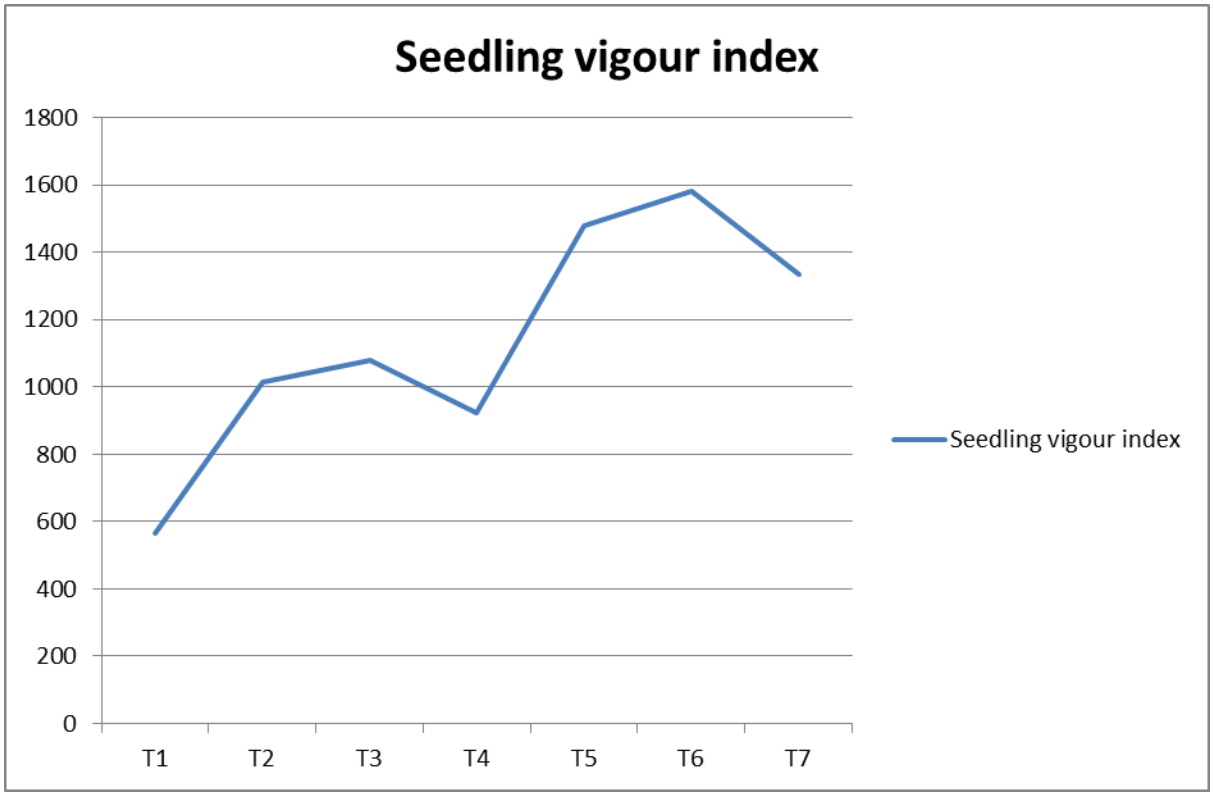

Fig. 8. Seedling vigour index of karonda as influenced by cow urine and (GA_3)

CONCLUSION

Germination of karonda seeds and morphological characters of karonda seedlings can be enhanced when seeds are maximum germinated were soaked in GA_3 100 ppm for 24 hours.

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