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Growing media and cow urine influence the seed germination and seedling growth of Papaya (*Carica papaya* L.)

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ABSTRACT

This study was conducted to investigate the effect of growing media and cow urine on seed germination and seedling growth of papaya. Results showed that soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) with cow urine was better for seed germination and seedling growth of papaya. The minimum days required for first germination (6.17 days), for 50 per cent germination (9.00 days), minimum span of germination (19.17 days) and maximum germination percentage (90.24 %) were observed in treatment of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) with cow urine. Shoot parameters viz., height of seedling, number of leaves per seedling and stem girth of papaya were influenced significantly by different growing medias and cow urine. The maximum seedling height (15.48 cm), number of leaves (9.83) and stem girth (7.75 mm) were recorded in treatment of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) with cow urine at 75 days after sowing. From the context of research, it can be determined that the treatment combination soil + sand + vermiculite + cocopeat + perlite (1:1:1:1) with cow urine is preferable to the other treatment combinations for good growth of papaya seedlings.

***Keywords*:** Cow urine, germination, growing media, growth, papaya.

The papaya (*Carica papaya* L.) is a tropical fruit belonging to the Caricacaeae family, with a total area and production of 1,44,000 hectares and 59,51,000 MT in India, respectively (Anonymous, 2021). Papaya grows in very well-drained, organically rich soil with a pH range of 5.5-6.7 (Morton, 1987). Trees on waterlogged soils frequently die within 3-4 days, with optimal development occurring around 22-26°C temperatures and 100-150 cm of uniformly distributed rainfall (Storey, 1985). Papaya is grown commercially by seed that is encased in a gelatinous sarcotesta and takes 3-5 weeks to germinate. Papaya seed germination is sluggish and often partial (Desai *et al*., 2017). To enhance seed germination and minimize germination time with proper growth environment, seed treatment is necessary. Cow urine is a unique dairy product with several properties, including manure, antibacterial agent, and disinfectant. Cow urine is a more cost-effective alternative to synthetic pesticides, which may be dangerous to farmers, marketers, customers, and the environment. Growing medias, also known as substrates, are any soil components other than soil that, alone or in combination, can provide superior conditions than agricultural soil (for one or more aspects). Because it is cheap and easy to get, earth is frequently utilized as a basic media. To supply enough nutrients for the seedlings, organic matter (vermiculite, perlite, and cocopeat) is added, and the soil is supplied to make the medium more porous. Perlite and vermiculite are typical nursery materials and they offer aeration, drainage, and the ability to store and release large amounts of water as needed. Cocopeat is a component of a growth medium with the right pH, EC, and other chemical properties (Abad *et al*., 2002). Growing mediums influenced seedlings quality (Wilson *et al*., 2001). In light of the foregoing, the current study examined how various medium and cow urine influence seed germination and development of papaya seedlings.

The following research was carried out in the nursery section of the Department of Horticulture, College of Agriculture, Ummedganj, in July 2019. This experiment was designed in a Factorial Complete Randomized Design (Panse and Sukhatme, 1967) with 11 media combinations and 22 treatments. Treatments namely, soil (Black cotton soil) (control) (T_0), soil + sand (1:1) (T_1), soil + vermiculite (1:1) (T_2), soil + cocopeat (1:1) (T_3), soil +perlite (1:1) (T_4), soil + vermiculite + perlite (1:1:1) (T_5), soil + vermiculite + cocopeat (1:1:1) (T_6), vermiculite + perlite + cocopeat (1:1:1) (T_7), soil + sand + vermiculite + perlite (1:1:1:1) (T_8), soil + sand + vermiculite + cocopeat (1:1:1:1) (T_9), soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) (T_{10}). To prepare cow urine solution (collected from desi cow in fresh form) of required concentrations *i.e.*, 15% was dissolved in small quantity of water and then the volume was made up by adding 1 litre of water to get the desired concentration. Papaya seeds (cultivar Arka Suyra) were soaked in cow urine solution for 24 hours and then sown in protrays.

During the experiment, germination characteristics such as days required for first germination, days required

Short Communication

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for 50% germination, germination percentage, and germination span were recorded (days). Vegetative growth characteristics, such as seedling height, number of leaves per seedling and stem girth, were observed at 15-day intervals for a total of 75 days following seeding. The days taken to initiate germination were used to compute the number of days necessary for initial germination. In all treatments, the days on which 50% of the seed germinated were recorded from the day of planting, and the total days required for 50% germination were computed. The percentage of germination was determined by subtracting the total number of germinated seeds from the total number of seeds planted. From the date of seeding to the conclusion of germination, the total number of days was determined. A meter scale was used to measure the seedling's height in centimeters from the root to the growing tip. A digital verniear caliper was used to measure the stem diameter of five tagged seedlings separately.

Germination attributes

Table 1 shows the days required for papaya seed to germinate for the first time, as impacted by different rooting media, cow urine, and their interaction treatments. The effect of varied rooting media on the number of days necessary for first germination of papaya seed indicated that it had a significant impact on the number of days required. In comparison to the rest of the rooting media, the medium containing of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1) required shortest time (7.00) to germinate the seeds. T_0, on the other hand, required the longest time to germinate (10.00 days). The seed that had been treated with cow urine had a substantial impact on the number of days it took for the seed to germinate for the first time. The treatment T_{10} with cow urine required the fewest days (6.17) for first germination, whereas the treatment T_0 (control) with cow urine required the most days (9.17) for first germination. The results in the table also demonstrate that applying cow urine had no influence on the number of days it took for seeds to germinate for the first time. However, with cow urine, the minimum days necessary for initial germination were observed (6.17) as compared to 10.00 days without cow urine.

Data on the number of days required for 50% germination related to the effects of various rooting medium, cow urine, and their interactions (Table 1) revealed that in T_{10}, the minimal number of days (10.50) necessary for 50% germination was observed. At 75 DAS, treatment T_9 was shown to be comparable to treatment T_{10}. However, the control (Soil) had the highest number of days (13.17) for 50% germination, which remained substantially greater than the other treatments. Furthermore, the findings show that applying cow urine had a substantial impact on the number of days necessary for 50% germination. The T_{10} cow urine treatment (12.17) was shown to be substantially better than the control in terms of mean minimum days (9.00). T_9, on the other hand, was on par with T_{10} at 75 DAS. This also revealed that the use of various media and cow urine interaction treatments had a substantial impact on the number of days necessary for seed to germinate 50% of the time. Treatment T_{10} with cow urine was found to be superior to the soil without cow urine, *i.e.* control (13.17) and other treatments in terms of the lowest days (9.00) required for 50% germination.

The germination affected by application of media, cow urine and their interaction (Fig. 1) revealed that the germination percentage was influenced by use of various rooting medium combinations. It clearly shows that maximum germination percentage (86.20) was found in treatment T_{10} which was significantly higher as compared to mean minimum germination per cent (72.50) at treatment T_0 (control).The germination percentage of papaya seed is also influenced significantly by use of cow urine. The maximum germination percentage (90.24) was found in treatment T_{10} with cow urine and minimum (74.59) was recorded under treatment T_0 with cow urine.The greatest germination percentage (90.24) was observed under the rooting medium treatment T_{10} with cow urine.

The data on span of germination affected by different rooting media (Fig. 2) reveals that it had significant effect on span of germination medium consisting of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) which took minimum (20.50 days) span of germination of the seed which was significantly minimum over the medium soil alone (control) *i.e.* 23.17 days. However, the treatment T_9 was at par with T_{10} at 75 DAS.The data in table also show that application of cow urine significantly affected the span of germination. The minimum span of germination (19.17days) was noted in treatment T_{10} with cow urine which was lower as compared to 22.00 days, recorded without cow urine treatments. The interaction of media and cow urine did not have any significant effect on span of germination.

Shoot attributes

The effect of various medium on seedling height (Fig. 2) reveals that it had a substantial effect on seedling height on all days of observation from seed sowing to 75th days after sowing. The treatment T_{10} resulted maximum height (13.51 cm) of seedling after 75th days of sowing followed by T_9 which was at par with T_{10} at 75 DAS. That was significantly superior over the all treatments including control (10.91 cm) and T_1 was also at par with T_0 at 75th DAS. However, at 75th days of

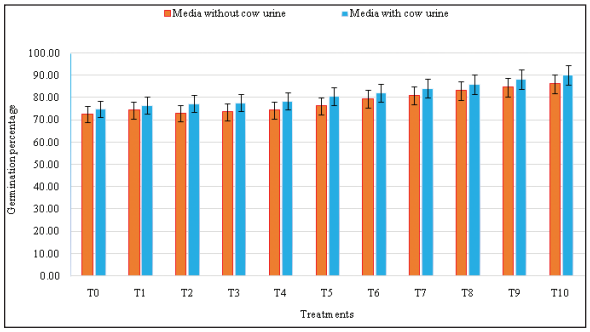

Fig. 1: Effect of growing media and cow urine on germination per cent in papaya (*Carica papaya* L.)

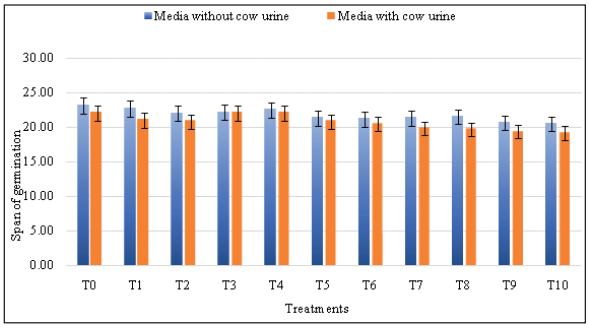

Fig. 2: Effect of growing media and cow urine on span of germination in papaya (*Carica papaya* L.)

sowing the maximum height of seedling (15.48 cm) was noted with cow urine treatment T_{10}as compared to 11.56 cm recorded with cow urine treatment T_0 on the same date of observation. However, the treatment T_9 was found at par with $T_{10.}$. Similarly, the interaction of rooting media and cow urine treatments also had the significant effect on height of seedling on each day of observation *i.e*. at 15, 30, 45, and 75th days of sowing. However, the highest seedling height (15.48 cm) was recorded in T_{10} with cow urine on the 75th day after seed sowing. On the last day of observation, *i.e*. 75 days after planting, the lowest height of seedling (10.91 cm) was observed in medium treatment T_0 (Soil without cow urine). At 60 days after planting, the combination of rooting medium and cow urine treatment showed no significant influence on seedling height.

During the experiment, the number of leaves per plant varied significantly according to the different rooting medium of soil and cow urine used. The results (Table 3) demonstrated that the medium combinations had a substantial impact on the number of leaves per seedling on all days of observation from the first to the 75th day after planting. However, after 75 days of planting, the rooting medium treatment T_{10}had the highest number of leaves per seedling (8.80), outperforming all other treatments in the research, including control. At 75th DAS, however, T_9 was found to be on level with T_{10}, while T_1 was likewise on par with T_0. At the end of the trial, the lowest number of leaves per seedling (6.17), was observed under control. The number of leaves at 15, 30, 45, 60, and 75 days after planting were substantially impacted by cow urine treatment, according to a table analysis. On the 75th day of planting, the greatest number of leaves per seedling was 9.83 in treatment T_{10} with cow urine, followed by T_9, compared to 7.5 leaves per seedling in treatment T_0 with cow urine (T_0). Similarly, the combination of rooting media and cow urine treatments had a substantial impact on the number of leaves on each observation day, *i.e.* 15, 30, 45, 60, and 75 days after planting. Nonetheless, the highest number of leaves (9.83) was recorded in T_{10} with cow urine on the 75th day of seed planting. On the last day of observation, *i.e*. 75 days after planting, the smallest number of leaves (6.17) was observed in medium treatment T_0 (Soil without cow urine).

The stem girth was affected significantly by the various medium, cow urine, and their combinations. The results on stem girth of papaya seedlings as impacted by different media (Table 4) shows that it had a substantial effect on stem girth of papaya seedlings on all observation days from 15 to 75 days after planting. On 75th days of sowing the medium treatment T_{10}exhibited maximum stem girth (7.69 mm) of papaya seedling while minimum (7.05 mm) was found in treatment T_0 at 75th day of observation. Likewise, the stem girth of papaya seedling on 15,30,45,60 and 75 days of sowing was influenced by application of cow urine. At 75th days of seed sowing the maximum stem girth (7.75 mm) of papaya seedling was noted in treatment T_{10} with cow urine as compared to treatment $T_0$with cow urine (7.18 mm). The interaction effect of media and cow urine was found significant on stem girth at 75th day of sowing. However, the maximum stem girth (7.75 mm) was recorded under treatment T_{10} with cow urine, while, the minimum stem girth (7.05 mm) was noted in treatment T_0 at same day.

Germination attributes

During the experiment, the number of days required for initial germination, the number of days required for 50% germination, the germination percentage, and the span of germination of papaya seedlings all had a significant impact on germination parameters. Under treatment T_{10} (soil + sand + vermiculite + cocopeat + perlite 1:1:1:1:1) with cow urine, the minimum days required for first germination (6.17), days required for 50% germination (9.00), maximum germination per cent (90.24%), and germination span (19.17 days) were recorded.

The combined medium treatment (soil + sand + vermiculite + vermicompost + cocopeat + cow urine) had the highest level of germination attributes, which

Table1: Effect of growing media and cow urine on days required for first germination and 50 % germination of papaya

Treatments	Days required for first germination		Days required for 50 per cent germination	
	Without cow urine	With cow urine	Without cow urine	With cow urine
T_0	10.00	9.17	13.17	12.17
T_1	9.50	8.83	12.67	11.33
T_2	8.83	8.17	11.83	11.00
T_3	9.67	9.17	12.00	12.50
T_4	9.00	8.17	12.50	12.00
T_5	8.17	7.00	11.33	10.83
T_6	8.00	7.00	11.00	10.50
T_7	7.50	6.83	11.17	9.83
T_8	7.33	6.67	11.33	9.67
T_9	7.83	7.33	10.67	9.33
T_{10}	7.00	6.17	10.50	9.00
Mean	**8.47**	**7.67**	**11.65**	**10.74**

	Days required for first germination			Days required for 50 per cent germination		
	Media (M)	Cow urine (C)	M × C	Media (M)	Cow urine (C)	M × C
SEm(±)	0.09	0.04	0.13	0.11	0.05	0.16
LSD(0.05)	0.26	0.11	NS	0.30	0.13	0.43

could be due to the beneficial effect of all components in improving the physical, biological, and chemical properties of the medium, as soil provides natural support, sand provides proper aeration, allowing more oxygen, which promoted more germination, and cocopeat and p (Hartmann and Kester, 1997). The capacity of the medium to retain more water and air aided in the synthesis of metabolites for cell proliferation as well as the breakdown of the seed coat, allowing the embryo to mature into a seedling earlier than expected. Hasan *et al*. (2010) devised a method for enhancing seed germination. In papaya, Deb *et al*. (2010) and Kumawat *et al.* (2014) found similar results, while Patil *et al.* (2012) found similar results in Rangpur lime. In organic matter-rich development settings, organic acid is plentiful, thus more easily accessible moisture and certain acids may have aided seed germination (Bisla *et al*., 1984). The medium's promising seed germination impact can be ascribed to its appropriate cation exchange capacity for nutrient retention, as well as its good water holding capacity and sufficient porousness to allow for enough moisture and gas exchange between the germination growth media and the embryo. According to Narayan *et al*. (2008) and Bihari *et al*. (2009) in aonla, it is essential for quick and uniform seed germination. When utilizing cocopeat as a growth medium component in papaya, Mandal *et al*. (2015) and Ramteke *et al*. (2015) obtained similar results. It's possible that the presence of organic acid in organic matter-containing media is to blame. As a result, more easily available moisture and certain acids may have aided seed germination (Bisla *et al*., 1984). This might be attributed to a general improvement in the rooting media's physical and chemical characteristics (Dilip *et al*., 1994).

Shoot attributes

During the experiment different media and cow urine had significant effect on shoot parameters like height of seedling, number of leaves per plant and stem girth of papaya seedling. It is evident from the data that the maximum height of seedling (4.56, 6.50, 9.98, 11.41, and 15.48 cm), number of leaves (4.10, 6.12, 6.17, 8.33 and 9.83) and stem girth (1.99, 3.65, 4.69, 5.95 and 7.75mm) at 15, 30, 45, 60 and 75 days after sowing were recorded under treatment T_{10} (soil + sand + vermiculite + cocopeat + perlite 1:1:1:1:1) with cow urine whereas the minimum height of seedling (2.80, 3.27, 6.50, 8.62 and 10.91cm), number of leaves (2.17, 3.00, 4.17, 5.00 and 6.17 cm^2) and stem girth (1.51, 2.95, 4.18, 5.21 and 7.05 mm) at 15, 30, 45, 60, 75th day of sowingwere observed in T_0 (control) without cow urine.

This might be because cow urine contains growth-promoting chemicals (auxins) and nutrients, as well as the appropriate medium. By maintaining a high water content in cells, speeding cell division and elongation, and promoting seed germination and overall seedling growth, cow urine also helped to improve seed vigour and dry weight of root and shoot seedlings. Shinde and

Table 2: Effect of growing media and cow urine on height of seedling (cm) of papaya

Treatments	Without Cow Urine					With Cow Urine				
	15 DAS	30DAS	45 DAS	60 DAS	75 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
T_0	2.80	3.27	6.50	8.62	10.91	2.99	4.64	7.90	9.21	11.56
T_1	2.82	3.35	6.70	8.78	11.05	3.04	4.75	8.10	9.35	11.81
T_2	2.97	3.50	7.00	9.00	11.48	3.32	4.90	8.30	9.50	12.01
T_3	3.24	3.90	7.16	9.17	11.82	3.58	5.08	8.45	9.81	12.65
T_4	2.85	3.35	6.67	8.75	11.02	3.15	4.76	8.07	9.38	12.95
T_5	3.42	4.10	7.60	9.42	12.15	3.79	5.20	8.75	9.91	13.50
T_6	3.50	4.62	8.00	9.56	12.50	4.00	5.50	9.00	10.23	14.02
T_7	3.56	5.00	8.17	9.75	12.75	4.09	5.83	9.17	10.50	14.38
T_8	3.82	5.60	8.61	10.00	13.05	4.20	6.10	9.56	10.81	14.96
T_9	4.02	6.00	8.76	10.21	13.35	4.31	6.38	9.87	11.23	15.21
T_{10}	4.10	6.12	8.89	10.34	13.51	4.56	6.50	9.98	11.41	15.48
Mean	3.37	4.43	7.64	9.41	12.14	3.73	5.42	8.83	10.12	13.50

	15 DAS			30 DAS			45 DAS			60 DAS			75 DAS		
	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C
SEm(±)	0.012	0.029	0.041	0.023	0.054	0.076	0.036	0.083	0.118	0.039	0.092	0.13	0.06	0.14	0.198
LSD(0.05)	0.036	0.083	0.118	0.066	0.154	0.218	0.102	0.238	NS	0.112	0.262	NS	0.171	0.401	0.567

Table 3: Effect of growing media and cow urine on number of leaves of papaya

Treatments	Without Cow Urine					With Cow Urine				
	15 DAS	30DAS	45 DAS	60 DAS	75 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
T_0	2.17	3.00	4.17	5.00	6.17	2.80	3.27	4.50	6.17	7.50
T_1	2.33	3.20	4.30	5.17	6.33	2.82	3.35	4.67	6.33	7.67
T_2	2.50	3.50	4.50	5.33	6.67	2.97	3.50	4.83	6.50	8.00
T_3	2.83	3.67	4.33	5.50	7.17	3.24	3.90	5.00	6.67	8.17
T_4	2.33	3.17	4.27	5.20	6.33	2.85	3.35	4.67	6.20	7.67
T_5	3.17	3.83	4.67	5.67	7.33	3.42	4.10	5.33	7.00	8.50
T_6	3.33	4.00	4.80	5.83	8.00	3.50	4.62	5.50	7.50	9.00
T_7	3.50	4.17	5.00	5.90	8.20	3.56	5.00	5.83	7.67	9.17
T_8	3.67	4.20	5.17	6.00	8.33	3.82	5.60	6.00	8.00	9.50
T_9	3.83	4.33	5.33	6.10	8.71	4.02	6.00	6.10	8.20	9.67
T_{10}	4.00	4.50	5.50	6.17	8.80	4.10	6.12	6.17	8.33	9.83
Mean	3.06	3.77	4.73	5.62	7.46	3.48	4.08	5.32	7.14	8.60

	15 DAS			30 DAS			45 DAS			60 DAS			75 DAS		
	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C
SEm(±)	0.009	0.021	0.030	0.016	0.039	0.055	0.024	0.056	0.079	0.029	0.067	0.095	0.037	0.088	0.124
LSD(0.05)	0.026	0.060	0.085	0.047	0.111	0.156	0.068	0.159	0.225	0.082	0.192	0.271	0.107	0.251	NS

Table 4: Effect of growing media and cow urine on stem girth of papaya

Treatments	Without Cow Urine							With Cow Urine						
	15 DAS	30DAS	45 DAS	60 DAS	75 DAS	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS				
T_0	1.51	2.95	4.18	5.21	7.05	1.54	3.08	4.30	5.39	7.18				
T_1	1.52	3.02	4.29	5.32	7.12	1.56	3.09	4.31	5.40	7.19				
T_2	1.53	3.04	4.29	5.35	7.14	1.59	3.14	4.36	5.44	7.24				
T_3	1.55	3.09	4.31	5.40	7.19	1.67	3.22	4.44	5.52	7.32				
T_4	1.57	3.11	4.33	5.42	7.21	1.72	3.31	4.49	5.62	7.41				
T_5	1.62	3.18	4.39	5.48	7.28	1.81	3.45	4.56	5.75	7.55				
T_6	1.69	3.28	4.46	5.58	7.38	1.84	3.48	4.56	5.75	7.55				
T_7	1.52	2.96	4.20	5.22	7.06	1.78	3.41	4.54	5.71	7.51				
T_8	1.54	3.39	4.22	5.25	7.11	1.89	3.54	4.64	5.84	7.64				
T_9	1.76	3.59	4.22	5.25	7.11	1.93	3.58	4.66	5.88	7.68				
T_{10}	1.94	3.99	4.67	5.89	7.69	1.99	3.65	4.69	5.95	7.75				
Mean	1.61	3.15	4.35	5.44	7.25	1.76	3.36	4.51	5.66	7.46				
	15 DAS			30 DAS			45 DAS			60 DAS			75 DAS		
	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C	M	C	M × C
SEm(±)	0.02	0.01	0.03	0.03	0.01	0.05	0.05	0.02	0.06	0.07	0.03	0.09	0.08	0.03	0.11
LSD(0.05)	0.05	0.02	0.08	0.09	0.04	0.13	0.13	0.06	0.19	0.19	0.08	0.27	0.23	0.10	0.32

Malshe (2015) obtained similar findings in Khirni using cow urine as a seed soaking medium.

The cow urine includes physiologically active compounds such as growth regulators, nutrients, and trace elements, and the media offered improved conditions for optimal seedling growth and development, such as aeration and porosity, resulting in enhanced seed germination and seedling height (Munoz, 1988). Cow urine concentrations were shown to increase the performance of all phenotypic characteristics of Methi and Bhindi in pot culture tests. Fresh and dry leaf mass, fresh and dry stem mass, stem length, fresh root mass, fresh head mass, and commercial yield all were improved as the concentrations of cow urine rose. The growth components in Panchagavya help plants grow quicker and produce more. Regardless of concentration, seedlings treated with cow urine exhibited higher protein and carbohydrate content than the control.

CONCLUSION

This research work concluded that the best quality papaya seedlings were obtained when seeds sown in medium consisting soil + sand +vermiculite + cocopeat + perlite (1:1:1:1:1) seed treatment with cow urine.This treatment has given significantly maximum germination percentage, height of seedling, number of leaves per seedling, diameter of stem and minimum days required for first and 50 per cent germination and span of germination over control. Therefore, it is recommended that this medium combination along with urine should be used for better germination and growth of papaya seed by orchardist.

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