Effect of Growing Media and Cow Urine on Seedling Growth, Leaf Nutrient Status and Economics of Papaya (*Carica papaya* L.)

ABSTRACT

In recent decades, research attention is focusing on utilize animal wastes for the quality planting material production with the various growing media. In this study, a pot experiment was conducted on papaya cv. Arka Surya at the nursery unit of the Department of Horticulture, Agricultural University of Kota, Rajasthan to assessment the impact of growing media and organic liquid (cow urine) on seedling growth, leaf nutrient status and economic attributes. This experiment was laid out in a factorial complete randomized design with two factors consisting eleven growing media and two levels of cow urine (with or without). Among different treatments combination used the medium Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1) with cow urine found significantly superior over other treatments and control with respect to maximum leaf area (51.85 cm^2), vigour index-I (1550.27 cm), vigour index-II (59.55 g), fresh weight of seedling (2.86 g) and dry weight of seedling (0.42 g) at 75 days after sowing. The highest number of secondary roots (17.00)were also found in the same treatment as compared to rest of the treatments. Further, it was also found superior with relation to maximum nitrogen (1.87%), phosphorus (1.14%) and potassium (2.26%) content.The highest number of stout and healthy seedlings (9000) per 250 g seeds. Therefore, maximum total gross return (₹ 90000) obtained by selling of these seedlings with higher net income (₹ 17363) due to treatment T_{10}-Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1) with cow urineover control.However, it is recommended that Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1) with cow urineshould be used for healthier growth and higher nutrient quality with more net profitability.

Keywords:Papaya, Growing Medium,Cow Urine, Growth, Leaf Nutrients, Economics.

1. INTRODUCTION

"Papaya (*Carica papaya* L.) is a tropical fruit crop and belongs to family Caricacaeae having commercial importance because of its high nutritive and medicinal value. It is native of tropical America and was introduced to India in 16th century. It is being grown in almost all tropical and subtropical countries in the world like Sri Lanka, Tanzania, India, Hawaii, Florida, Philippines, South Africa and Australia. In India it extensively grown in various states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, West Bengal, Chhattisgarh, Tamil Nadu, Assam and Kerala" (Desai *et al*., 2017). "In Rajasthan papaya is grown in Bhilwara, Bharatpur, Chittorgarh, Dausa, Jaipur, Karauli and Udaipur districts. The most beneficial conditions for papaya growth are well-draining and well-aerated soils containing rich organic matter" (Morton, 1987). "Typically, plants die within 3-4 days in water-logged soils" (Storey, 1985). "The composition of the medium influences the quality of the seedlings" (Wilson *et al*., 2001).

"Growing media of different origin take on the role of soil and provide anchorage for the root system, supply water and nutrients for the plant and guarantee adequate aeration in the root area" (Gruda *et al*., 2006)."Cow urine is a unique product of dairy which have huge property such as manure, antimicrobial agent and disinfectant. It contains 95 per cent water, 2.5 per cent urea and 2.5 per cent enzymes" (Randhawa and Sharma 2015). "In organic farming cow urine is used for preparation of number of growth promoter and bio-pesticides which are effective in improving soil fertility and management of large number of pests and diseases in varied groups. The biochemical contents of the plants increased with cow urine

application. Therefore, the use of cow urine provides better alternative to synthetic chemicals which are expensive and pose potential danger to the farmers, marketers, consumers and environment. Cow urine contains about 1.21 per cent N_2, 0.01 per cent, P_2O_5 and 1.35 per cent K_2O with micronutrients like, Fe, Mn, Zn and Cu"(Subramanian, 2005). Accordingly, this study was carried out in order to determine the effect of growing media and cow urine on the seedling growth, leaf nutrient status and economics of papaya seedlings.

2. MATERIALS AND METHODS

A pot experiment on papaya cv. Arka Surya was conducted at the nursery unit of the Department of Horticulture, Agricultural University of Kota, Rajasthan which was located in a semi-arid climatic regies the soil fertility. Cow urine has amazing germicidal power to kill wide varieties of germs (onduring the month of July in the year 2019. In this investigation consisting of 2 factors*i.e.* growing media or rooting media and cow urine.During the investigation used 11 media combinations with or without cow urine, comprising of total 22 treatments, *i.e.* 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 make the 15% cow urine solution, a small amount of 150 ml cow urine was dissolved in 1 literwater and treated papaya seed for 24 hoursafter that sown in trays.

The leaf area was calculated using a graph paper and expressed as a centimetre square (cm^2). Vigour index- I and II were calculated according to formula given by Abdul-Baki and Anderson (1973);

Seedling vigour index I = Germination percentage × Seedling length (cm)

Seedling vigour index II = Dry weight of seedlings (g) × Germination percentage

The number of secondary roots were counted after 75 days of sowingfrom each replication after uprooted of seedling. Fresh weight of seedling was measured by electronic balance at 75 days after sowing and average weight was expressed in gram. The seedlings which were earlier selected for fresh weight dried in oven at 60°C for 48 hours till a uniform drying and it was measured by electronic balance and expressed in gram.

Nitrogen content in leaves was estimated by using micro Kjeldahl distillation method (AOAC, 1999).Phosphorus content in leaves was determined by Vando-molybdophophate yellow colour method (Jackson, 1973) and potassium content in leaves was determined by Flame photometric method (Jackson, 1973).The economic attributes of healthy seedlings obtained from various treatments was converted into gross return in rupees based on the current market prices for the sale.After subtracting the gross return of control from the gross return of other treatments, the additional income over control for each treatment was determined and after subtracting the additional treatment cost from additional income over control, the net profit due to treatment was determined.

The data pertaining to various parameters on growth, nutrient content of seedlings was subjected to statistical analysed with factorial completely randomized design(Panse and Sukhatme, 1985). Person correlation matrix among the various attributes was analysed using R software (R version 4.2.3, India).

3. RESULTS AND DISCUSSION

3.1 Effect of growing media and cow urine on growth attributes

The leaf area of papaya seedlings has been influenced significantly by rooting media and cow urine (Figure 1). In treatment T_{10}-Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1) observed highest leaf area (49.77 cm^2) and which was followed by T_9 (49.49 cm^2), while, smallest leaf area (36.19 cm^2) was noted in T_0-(Control). Application of cow urine significantly influenced leaf area and registered highest (44.88 cm^2) with cow urine application, while, lowest leaf area (41.45 cm^2) was observed without application of cow urine. Whereas, the interaction effect between growing media and application of cow urine was noted statistically non-significant for leaf area.However, Vigour index-I and II of papaya seedling were affected significantly by various growing media and cow urine application at 75 DAS (Table 1). In growing media containing Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1)-T_{10} recorded higher vigour index-I and II (1308.12 and 56.50, respectively) as compared to other treatments of growing media. While, in T_0 (Control) registered lower vigour index-I and II (643.43 and 30.17, respectively). Application of cow urine influenced significantly of VI-I and II and observedhigherVI-I and II (1054.43 and 40.85, respectively) with the application of cow urine. However, lower VI-I and II (799.31 and 35.90, respectively) observed without application of cow urine. The combine effect of growing media and cow urine was registered statistically significant for VI-I and II. Maximum VI-I and II (1550.27 and 59.55, respectively) were noted in T_{10} with cow urine, whereas, treatment T_0 without cow urine showed lower VI-I and II (611.11 and 28.75, respectively). Application of cow urine with treatment $T_{10}$was followed by T_9 for VI-I and II (1382.58 and 51.22, respectively) with cow urine.

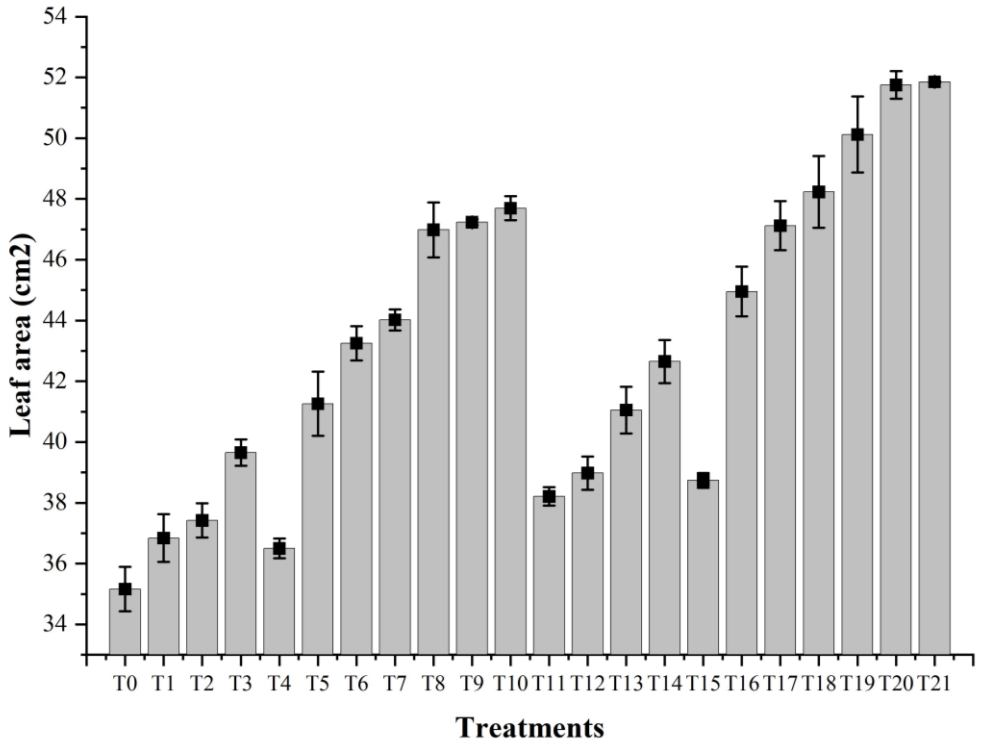


Fig. 1: Effect of growing media and cow urine on leaf area of papaya.

Table 1: Effect of growing media and cow urine on vigour index-I and II of papaya.

Treatments	Vigour index-I			Vigour index-II		
	Without Cow	With Cow	Mean	Without Cow	With Cow	Mean

	Urine	Urine		Urine	Urine	
T_0	611.11	675.75	643.43	28.75	31.58	30.17
T_1	659.89	754.97	707.43	30.49	34.40	32.45
T_2	673.93	823.50	748.72	30.66	35.61	33.14
T_3	711.38	912.56	811.97	32.35	35.03	33.69
T_4	745.37	945.51	845.44	33.42	36.90	35.16
T_5	798.51	1031.09	914.80	32.76	38.77	35.77
T_6	898.51	1130.32	1014.42	34.92	40.22	37.57
T_7	792.03	1133.54	962.79	36.39	38.77	37.58
T_8	863.90	1258.64	1061.27	38.22	47.25	42.74
T_9	972.10	1382.58	1177.34	44.03	51.22	47.63
T_{10}	1065.96	1550.27	1308.12	53.44	59.55	56.50
Mean	799.31	1054.43		35.90	40.85	
	Media (M)	**Cow urine (C)**	**M × C**	**Media (M)**	**Cow urine (C)**	**M × C**
SEm±	10.42	4.44	14.74	0.36	0.16	0.52
C.D. at 5%	29.71	12.67	42.02	1.03	0.47	1.50

Fresh and dry weight of papaya seedling were influenced significantly by various growing media and cow urine application (Table 2). In growing media consists Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1)-T_{10} registered maximum fresh and dry weight of seedling (2.54 and 0.37 g, respectively) as compared to rest of treatments of growing media. Whereas, in T_0 (Control) observed minimumfresh and dry weight of seedling (1.84 and 0.23 g, respectively). Application of cow urine affect significantly of fresh and dry weight of seedling and recordedmaximum (2.33 and0.33 g, respectively) with the application of cow urine. While, minimumfresh and dry weight of seedling (1.91 and 0.26 g, respectively) registered without application of cow urine. The interaction effect of growing media and cow urine was registered statistically significant for fresh and dry weight of seedling. Highestfresh and dry weight (2.86 and 0.42 g, respectively) were observed in T_{10} with cow urine, whereas, treatment T_0 without cow urine showed lowest fresh and dry weight (1.61 and 0.20 g, respectively). The number of secondary roots of papaya seedling affected significantly by using of different growing media and application of cow urine (Figure 2). Growing media consisting Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1)-T_{10}exhibited higher number of secondary roots (15.50) as compared to rest of the growing media and treatment T_0 (Control) exhibited lower number of secondary roots (11.84) of seedling. The effect of cow urine observed significant and maximum number of secondary roots of seedling (14.44) were recorded with cow urine application and minimum (12.80) was noted without application of cow urine. This attribute influenced significantly by combined treatment ofgrowing media and cow urine. The highestnumber of secondary roots (17.00) were recorded in treatment T_{10} with cow urine and treatment T_0-without cow urine enumeratedlowest (11.17).

The significant influence might be due to the presence of growth promoting substances (auxins) and nutrients in cow urine and various growing medias used during the experimentation, which leads to better growth of papaya seedlings.The combination of different growing medias *i.e.*soil, sand, vermiculite, perlite and cocopeat media,attributed proper aeration and high water holding capacitywhich helped to better growth and development of seedlings.These results were in close conformity with finding ofMandal *et al.* (2015), Singh *et al*. (2020), Sharma *et al*. (2021) and Sharma *et al*. (2023) in papaya.

Table 2: Effect of growing media and cow urine on fresh and dry weight of seedling of papaya.

Treatments	Fresh weight of seedling (g)			Dry weight of seedling (g)		
	Without Cow Urine	With Cow Urine	Mean	Without Cow Urine	With Cow Urine	Mean
T_0	1.61	2.06	1.84	0.20	0.26	0.23
T_1	1.91	2.43	2.17	0.25	0.29	0.27
T_2	1.94	2.15	2.05	0.26	0.30	0.28
T_3	1.92	2.19	2.06	0.22	0.27	0.25
T_4	1.74	2.29	2.02	0.25	0.28	0.27
T_5	2.01	2.21	2.11	0.27	0.36	0.32
T_6	1.77	2.22	2.00	0.28	0.33	0.31
T_7	2.09	2.54	2.32	0.24	0.30	0.27
T_8	1.82	2.32	2.07	0.28	0.39	0.34
T_9	1.98	2.31	2.15	0.29	0.40	0.35
T_{10}	2.22	2.86	2.54	0.32	0.42	0.37
Mean	1.91	2.33		0.26	0.33	
	Media (M)	**Cow urine (C)**	**M × C**	**Media (M)**	**Cow urine (C)**	**M × C**
SEm±	0.02	0.01	0.03	0.003	0.001	0.004
C.D. at 5%	0.06	0.02	0.08	0.008	0.003	0.011

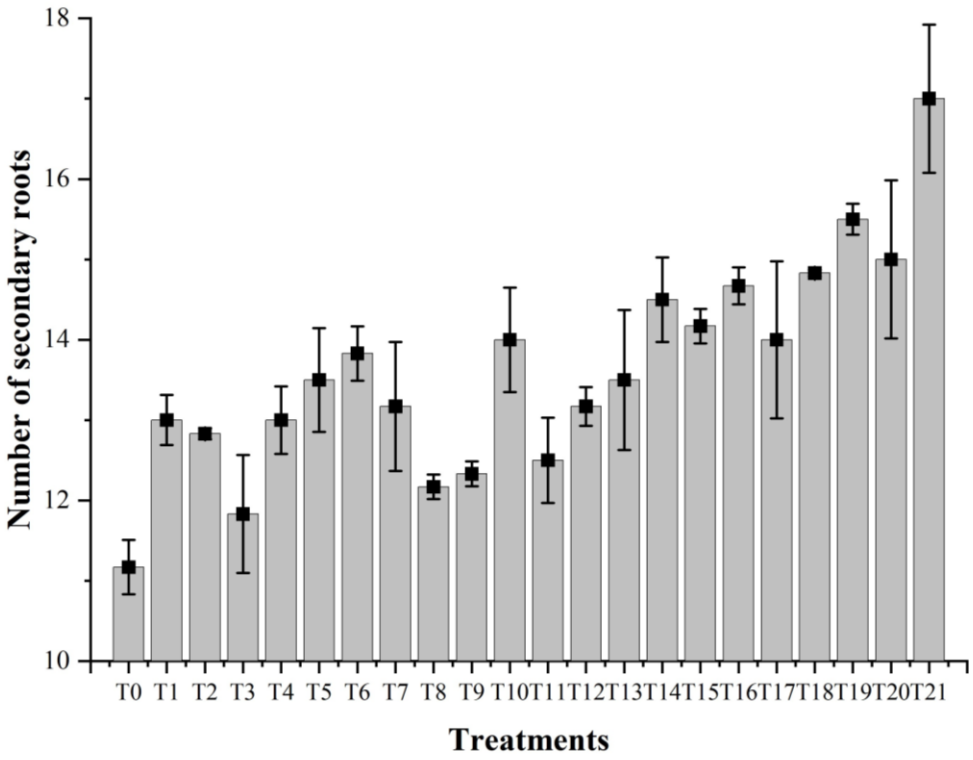


Fig. 2: Effect of growing media and cow urine on number of secondary roots of papaya seedling.

Cow urine contains many nutrients and plays a role in forming the plant's dry material andit can increase plant growth (Mali, 2021), due to availability of nitrogen content. Nitrogen plays a role in forming chlorophyll, amino acids, fats, enzymes and compounds needed in plant physiological processes to produce photosynthates. Further, the cow urine was maintaining of high water content in cell, increased cell division and cell elongation, which

increased the overall growth of the seedlings, which may, helped to increase seedling vigour and fresh and dry weight of root and shoot of papaya seedlings. These results were in close agreement with Shinde and Malshe (2015) in *Khirni* when they used cow urine as a seed soaking,Sutheesh *et al.* (2016) in sandalwood, Singh *et al*. (2020) and Sharma *et al*. (2023) in papaya.

3.2 Effect of growing media and cow urine on leaf nutrient status

Leaf nitrogen, phosphorus and potassium content of papaya seedling was affected significantly by various growing media and cow urine application at 75 DAS (Table 3). In growing media containing Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1)-T_{10} recorded higher nitrogen, phosphorus and potassium (1.78, 1.10 and 2.26 %, respectively) as compared to other treatments of growing media and it was followed by soil + sand + vermiculite + cocopeat (1:1:1:1)-T_9*i.e.* 1.76, 1.07 and 2.06 %, respectively. While, in T_0-(Control) registered lowest nitrogen, phosphorus and potassium (1.05, 0.47 and 1.39 %, respectively). Application of cow urine influenced the content of nitrogen, phosphorus and potassium and observed maximum (1.47, 0.82 and 1.85 %, respectively) with the application of cow urine. However, minimum nitrogen, phosphorus and potassium (1.36, 0.74 and 1.75 %, respectively) observed without application of cow urine. The combine effect of growing media and cow urine was registered statistically significant for leaf nutrient content. Maximum nitrogen, phosphorus and potassium (1.87, 1.14 and 2.26, respectively) were noted in T_{10} with cow urine and it was followed by T_9 (1.84, 1.12 and 2.19 %, respectively) with cow urine, whereas, treatment T_0 without cow urine registeredminimum nitrogen, phosphorus and potassium (1.02, 0.45 and 1.36 %, respectively).

Leaf nutrient content of papaya seedlings affected significantly due to the higher uptake of nutrients, particularly nitrogen when the seed socking with cow urine and grown in different growing media. Propagation media used in raising horticultural plants in the nursery are mostly organic or inorganic in nature and plays important role in seed germination not only acts as growing place but also as a source of nutrients for plant growth.This fact is supported by the works of Pafli (1965) that "the uptake of nitrogen, the chief constituent of chlorophyll, protein and amino acids is accelerated through its increased supply at appropriate time to the plants". "This might be due to stimulated nutrient uptake specially nitrogen and synthesis of chlorophyll which have role in the assimilation of numerous amino acids that, are subsequently incorporated in proteins and nucleic acid, which provides framework for chloroplast results into better chlorophyll content in leaves of plant under this treatment" (Ramteke *et al.,* 2016). "Cow urine can increase the concentration of uptake of N, P and K" (Mali, 2021).The cow urine and growing media contain significant amounts of major nutrients like nitrogen, phosphorus and potassium required for soil mineral balance and fertility. Singh *et al*. (2014) has reported that "high dose of cow urine application resulted in increased dissolved nutrients of amended soils". "Significantly higher soil organic carbon and available N, P and K were obtained with the applications of cow urine with other formulations" (Kgasudi *et al*. 2020).

Table 3: Effect of growing media and cow urine on leaf nitrogen, phosphorus and potassium content of papaya.

Treatments	Nitrogen content in leaf (%)			Phosphorus content in leaf (%)			Potassium content in leaf (%)		
	Without Cow Urine	With Cow Urine	Mean	Without Cow Urine	With Cow Urine	Mean	Without Cow Urine	With Cow Urine	Mean
T_0	1.02	1.07	1.05	0.45	0.49	0.47	1.36	1.41	1.39
T_1	1.10	1.15	1.13	0.49	0.53	0.51	1.45	1.54	1.50
T_2	1.21	1.30	1.26	0.61	0.68	0.65	1.56	1.67	1.62
T_3	1.31	1.42	1.37	0.69	0.75	0.72	1.65	1.77	1.71
T_4	1.11	1.21	1.16	0.50	0.55	0.53	1.48	1.56	1.52
T_5	1.36	1.47	1.42	0.76	0.82	0.79	1.76	1.89	1.83
T_6	1.43	1.52	1.48	0.81	0.90	0.86	1.85	1.96	1.91
T_7	1.51	1.62	1.57	0.86	0.95	0.91	1.91	2.03	1.97
T_8	1.62	1.76	1.69	0.92	1.05	0.99	2.01	2.11	2.06
T_9	1.68	1.84	1.76	1.01	1.12	1.07	2.10	2.19	2.15
T_{10}	1.69	1.87	1.78	1.05	1.14	1.10	2.16	2.26	2.21
Mean	1.36	1.47		0.74	0.82		1.75	1.85	
	Media (M)	**Cow urine (C)**	**M × C**	**Media (M)**	**Cow urine (C)**	**M × C**	**Media (M)**	**Cow urine (C)**	**M × C**
SEm±	0.005	0.012	0.016	0.003	0.008	0.011	0.02	0.05	0.07
C.D. at 5%	0.014	0.033	0.047	0.010	0.022	NS	0.06	NS	0.21

3.3 Effect of growing media and cow urine on economics

The data regarding the estimated relative economics of various treatment combinations presented in Table 4and revealed that the treatment T_{10}*i.e.*consists Soil + Sand + Vermiculite + Cocopeat + Perlite (1:1:1:1:1) with cow urine had used under study produced the maximum number of stout and healthy seedlings (9000) per 250 g papaya seeds.

Table 4. Effect of growing media and cow urine on relative economics of different treatments of papaya

Treatments		Additional treatment cost (₹)	No. of seedlings obtained from 250 g seeds *	Gross return of seedling (₹) **	Additional income over control (₹)	Net profit due to treatment (₹)
T_0	Without cow urine	0	7200	72000	0	0
T_1		200	7400	74000	2000	1800
T_2		600	7300	73000	1000	400
T_3		475	7300	73000	1000	525
T_4		850	7400	74000	2000	1150
T_5		1300	7600	76000	4000	2700
T_6		1135	7900	79000	7000	5865
T_7		1000	8000	80000	8000	7000
T_8		715	8300	83000	11000	10285
T_9		432	8400	84000	12000	11568
T_{10}		632	8600	86000	14000	13368
T_0	With cow urine	5	7400	74000	2000	1995
T_1		205	7600	76000	4000	3795
T_2		905	7700	77000	5000	4095
T_3		480	7700	77000	5000	4520
T_4		1705	7800	78000	6000	4295
T_5		1305	8000	80000	8000	6695
T_6		1140	8200	82000	10000	8860
T_7		1005	8400	84000	12000	10995
T_8		720	8500	85000	13000	12280
T_9		437	8800	88000	16000	15563
T_{10}		637	9000	90000	18000	17363

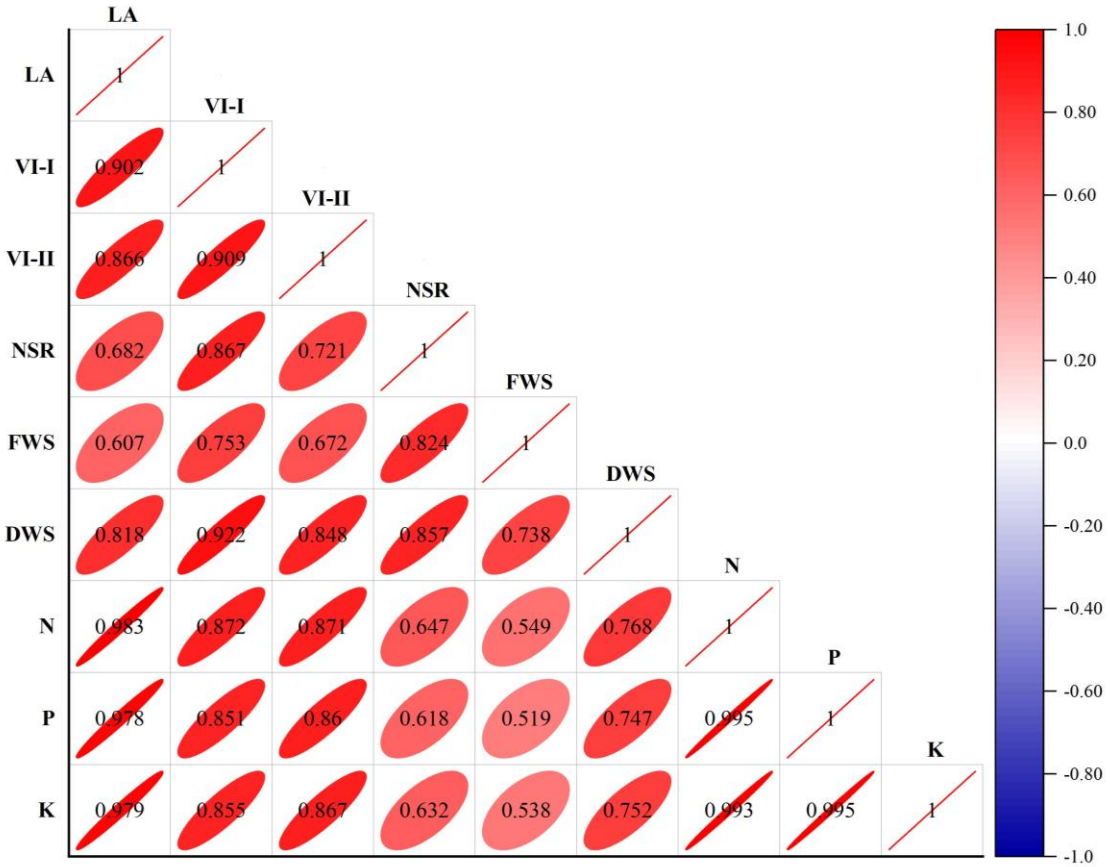
* 250g papaya seed contain 10000 seeds

** The cost of papaya seedling is ₹ 10 per seedling

Therefore, total gross return obtained by selling of these seedlings (@ ₹ 15 per seedling) appeared to ₹ 90000. This treatment also exhibited maximum net profit of ₹ 17363 and it was followed by treatment T_9 with cow urine (₹ 15563).Cow urine is used because of its yearlong availability, cost-effectiveness, special sanctity attached to the cow in India and high success rate of seedling production with higher net return.

3.4 Correlations among various parameters under the investigation

Significant correlations were observed between different growth and leaf nutrient contentattributes (Figure 3). The maximum positive correlation was observed between nitrogen and phosphorus (0.995) andphosphorus and potassium (0.995) which was followed with good significant positive correlations between nitrogen and potassium (0.993); leaf area and nitrogen (0.983); leaf area and potassium (0.979); leaf area and phosphorus (0.978); vigour index-I and vigour index-II (0.909); and leaf area and vigour index-I (0.902). The lowest significant positive correlation was observed between fresh weight of seedling andphosphorus (0.519) which was followed by potassium (0.538) and nitrogen (0.549).



Note: LA: Leaf area; VI-I: Vigour index-I, VI-II: Vigour index-II, NSR: Number of secondary roots, FWS: Fresh weight of seedling, DWS: Dry weight of seedling, N: Nitrogen content, P: Phosphorus content and K: Potassium content

Fig. 3: Correlation matrix using Pearson coefficients among various attributes of papaya cv. Arka Surya influenced by different growing media and cow urine.

4. CONCLUSION

In conclusion, growing media and cow urineinfluenced plant growth (leaf area, vigour index, number of secondary roots and weight of seedling) and leaf nutrient status (nitrogen, phosphorus and potassium content) of papaya during the experimentation. On the basis of result obtained from the pot experiment, best quality papaya seedlings were obtained with maximum estimated net income over controlwhen seeds sown in medium consisting Soil + Sand +Vermiculite + Cocopeat + Perlite (1:1:1:1:1) seed treatment with cow urine. Therefore, it is recommended that this growing media combination along with cow urine should be used for better growth and high nutrient quality with more net profitability by orchardist.

REFERENCES

Abdul-Baki, A. and Anderson, J.D. 1973. Vigour determination in soybean seed by multiple criteria. *Crop Science*. **13:** 630-633.

AOAC, 1999. Official Methods of Analysis Method 988.05.AOAC International, Gaithersburg, Md. Ch. 4, p. 13.

Desai A, Panchal B, Trivedi A, Prajapati D. 2017. Studies on seed germination and seedling growth of papaya (*Carica papaya* L.*)* cv. Madhu Bindu as influenced by media, GA3 and cow urine under net house condition. *Journal of Pharmacognosy and Phytochemistry*, 6(4):1448-1451.

Gruda, N., Prasad, M. and Maher, M.J. 2006. Soilless Culture. *In*: R. Lal (ed.) *Encyclopaedia of soil sciences*. Taylor & Francis, Boca Raton, Florida, USA.

Jackson ML. 1973. Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi.

Kgasudi, B.K. and Mantswe, M. 2020. Cow Urine: A Plant Growth Enhancer, Bio Fertilizer, Pesticide and Antifungal Agent. *International Journal of Current Microbiology and Applied Sciences*, 9: 1294-1298.

Mali, M. 2021. Cow Urine: A Gift to Agriculture. *Agric. Environ*., 2 : 22-33.

Mandal, B., Dash, A. K., Mishra, N., Mishra, P. P. and Ray, M. 2015. Studies on the effect of media and growth regulating substances on seed germination of papaya. *International Journal of Tropical Agriculture.* 33(4): 2621-2623.

Morton, J.F. 1987. Papaya. In: Morton JF (Ed) Fruits of Warm Climates, Creative Resource Systems, I. 336-346.

Pafli G. 1965. Relations between abundant N supply and amino acid concentration on leaves of rice plant. *Plant Soil,* 23: 275- 284.

Panse, V.G. and Sukhatme, P.V. 1985. Statistical methods for agricultural workers. *Indian Council of Agricultural Research Publication*, 87-89.

Ramteke, V., Paithankar, D. H., Baghel, M. M. and Kurrey, V. K. 2016. Impact of GA3 and propagation media on growth rate and leaf chlorophyll content of papaya seedlings.*Research Journal of Agricultural Sciences*, **7**(1): 169-171.

Randhawa, G. K. and Sharma, R. 2015. Chemotherapeutic potential of cow urine. *Journal of Intercultural Ethnopharmacology*,4(2): 180-186.

Sharma, P., Yadav, R.K., Jain, M.C. and Bhateshwar, M.C. 2021. Growing media and cow urine influence the seed germination and seedling growth of papaya (*Carica papaya* L.). *Journal of Crop and Weed*, 17(3):253-259.

Sharma, P., Yadav, R. K., Jain, M. C. and Bhateshwar, M.C. 2023. Improvement of papaya (*Carica papaya* L.) seed germination, seedling growth and chlorophyll content by using growing medium and organic liquid. *International Journal of Environment and Climate Change*, 13(9): 2496-2506.

Shinde, V.V. and Malshe, K.V. 2015. Effect of cattle urine and cow dung slurry as seed treatment on germination and growth of *Khirni* (*Manilkara hexandra* L.). *Journal of Eco-Friendly Agriculture*, 10(2):128-130.

Singh, M.K., Singh, R.P., Rai, S., 2014. Effect of nitrogen levels and cow urine on soil N status, growth and yield on paddy (*Oryza sativa* L.). *Environmental Ecology*, 32: 1277-1281.

Singh, R., Asre, A., Kumar, A. and Karde, A. 2020. Studies on seed germination and seedling growth of papaya (Carica papaya L.) as influenced by growing media, cow urine, cow dung and cow dung slurry under net house condition. *Progressive Horticulture*, 52(2): 162-165.

Storey, W. B. 1985. *Carica papaya*. In: Halevy AH (Ed) CRC Handbook of Flowering (Vol II), CRC Press Inc., Boca Raton, Florida.

Subramanian, A. 2005. Effect of Panchagavya on *Escherchia coli* in procured milk. *Indian Veterinary Journal*, 82: 799-800.

Sutheesh, V.K., Jijeesh, C.M. and Divya, T.P. 2016. Evaluation of organic and inorganic pre-treatments for better seed germination and seedling vigour in (*Santalum album* L.).*Plant Archives*, 16(1):143-150.

Wilson, S. B., Stoffela, P.J. and Graetz, D.A. 2001. Use of compost as media amendment for containerzed production of two subtropical perennials. *Journal of Environmental Horticulture,* 19: 37-42.