IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EFFECT OF FERMENTED FISH AND CHICKEN WASTE FOLIAR SPAY ON SEEDLING GROWTH CHARACTERISTICS OF KAPOK (*Ceiba pentandra.L)*

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Abstract: A pot culture experiment was conducted at Forest College and Research Institute, Mettupalayam with an objective of influence of seedling growth and its parameters by foliar application of fish and chicken waste on Kapok (*Ceiba pentandra. L*) with different treatment. The experiment was laid out in Randomized Block Design (RBD), with three replications *viz.*, T_1 -1% Fermented fish waste, T_2 -1% Fermented chicken waste, T_3 - 1% Fermented fish and chicken waste, T_4 - 2% Fermented fish waste ,T_5 -2% Fermented chicken waste , T_6 - 2% Fermented fish and chicken waste, T_7 - 3% Fermented fish waste,T_8 - 3 % Fermented chicken waste ,T_9 - 3% Fermented fish and chicken waste, T_{10} - Control. Foliar application was done once at 15 days interval. Totally three foliar applications were done. Observations on seedling height, number of leaves, stem girth, root shoot ratio, root volume were recorded. The results revealed that foliar application of 1% Fermented chicken waste registered significantly higher growth parameters than other treatments. It was on par with 2% Fermented fish waste. Foliar spray of 1% Fermented chicken waste could be recommended as liquid organic input to get higher growth of seedlings.

Index Terms **–** Fish waste. Chicken waste, Growth characters.

I. INTRODUCTION

Kapok was a tall, deciduous tree bearing short, sharp prickles all along the trunk and branches supported by pronounced buttresses at the base. It has a light crown and is leafless for a long period. The leaf is glabrous and digitate, being composed of 5, 7 or 9 leaflets. Seeds were sown in nursery and raised seedling for propagation. In early stage the seedling growth was smaller. Globally more than 50 % of the total fish capture is not used as food and involves almost 32 million tons of waste was raised. In India alone generates more than 2 million metric a tons of waste was raised due to fish processing activities. Also, more than 30 % of the remaining material from the total chicken production is not used as food and involves almost 21 million tons of waste was raised globally. India alone generates greater than 1.2 million metric tons of waste due to chicken processing activities**.** These much of the fish and chicken waste were dumped into the ocean annually in India. The use of chemical fertilizer and plant growth regulators can speed up seedling growth preferred by farmers in producing quality seedling. However, the excessive usage of chemical fertilizer causes air and ground water pollution and causing health problem in human. Therefore, the usage of organic fertilizer is an alternative way to replace the chemical one. Organic fertilizer is a natural fertilizer produced by the decomposition of animal and plant waste. Moreover, organic fertilizer is environmental friendly as it is produced without the use of chemicals. It is typically found to be an appropriate way of maintaining soil fertility and seedling growth (Ji et al., 2017). Fermented fish waste

(FFW) and fermented chicken waste(FCW) is one of the organic preparations which is used for improving seedling growth as a booster (Priyanka et al., 2019a). The FFW is prepared by mixing the fish waste with brown sugar and is left for a fermentation period of at least one month. It is of great importance for the growth of plants and microorganisms, since it contains different nutrients and amino acid types (Ramesh et al., 2020). During the early seedling growth stage of development, FFW and FCW are used as a nitrogen source to improve growth and size of seedling (Weinert et al., 2014). Foliar application or soil drenching of FFW and FCW may increase uptake and reduce runoff or leaching, providing the seedling with enough N for chlorophyll output to maintain plant health (Priyanka et al., 2019a).Commercially available chemical fertilizers and growth regulators are cost-effective way to supplement soil with nitrogen (N) for seedling growth, however, inappropriate or excessive use of fertilizers may lead to ground or surface water nitrate contamination.Weinert et al., 2014).Because of this issue, many researchers conducted research to produce an organic fertilizer that can be used by farmers without causing harm to the environment and the ecosystem. Therefore, the aim of the study is to determine the effect of fermented fish waste (FFW) and Fermented chicken waste (FCW) on seedling growth and development of *Ceiba pentandra* (Kapok) at different growth stages of seedling as a booster. This study aims to utilize the fish and chicken waste by fermenting them and used as seedling booster.

Materials and methods

. The pot culture experiment was conducted at Forest College and Research Institute, Mettupalayam, Tamil Nadu Agricultural University, during summer 2023 to find out the effect of foliar application of FFW and FCW on growth characteristics of kapok. The experiment was laid out in Randomized Block Design (RBD), with three replications *viz.*, T_1 -1% Fermented fish waste ,T_2 -1% Fermented chicken waste,T_3 - 1% Fermented fish and chicken waste ,T_4 - 2% Fermented fish waste ,T_5 -2% Fermented chicken waste , T_6 - 2% Fermented fish and chicken waste, T_7 - 3% Fermented fish waste,T_8 - 3 % Fermented chicken waste ,T_9 - 3% Fermented fish and chicken waste, T_{10} - Control. The pot culture experiment was conducted during summer months of May – June 2023. Mini clonal nursery is located in the Western Agro-Climatic Zone of Tamil Nadu and lies between 11.2^0 N latitude and 77.56^0 E longitudes with the altitude of 300 m MSL. During the experiment period, the maximum temperature ranged from 37.5ºC to 36.1ºC with the mean temperature of 36.8ºC and minimum temperature prevailed during the experiment period ranged from 24.0ºC to 25.7ºC with the mean of 24.85ºC. The mean relative humidity during morning and afternoon was 82.11 % and 42.56 %. The total rainfall received during the experiment period was 39.4 mm in 6 rainy days with mean evaporation of 6.97 mm. The mean bright sunshine hours were 8.36 hrs. Fermented fish waste was prepared as per the procedure described by Vincent *et al*. (2014). The fish waste was collected from nearby fish market for free of cost. 1 Kg of Fish Waste was cut down into small piece and they were mixed with finely powdered brown sugar. The mixed material was kept in air tight container / plastic bottle in cool dry place. The pH of the fish waste product was measured daily until it reaches the pH 4. The product was then filtered using filter gauze of 1 mm^2 pore size. The final product was viscous fluid and had smell of panchamirtham. Fermented chicken waste was prepared as per the procedure described by Vincent *et al*. (2014). The chicken waste was collected from nearby chicken market for free of cost. 1 Kg of chicken waste was cut down into small piece and they were mixed with finely powdered brown sugar. The mixed material was kept in air tight container / plastic bottle in cool dry place. The pH of the chicken waste product was measured daily until it reaches the pH 4. The product was then filtered using filter gauze of 1 mm^2 pore size. The final product was viscous fluid and had smell of panchamirtham. Plant height was recorded from the ground level to the growing tip of the main shoot at 15, 30, 45 days. Measurements were taken from three tagged plants in each treatment and the average height was calculated and expressed in cm. Stem girth (cm) was measured at 15, 30, 45 DAS just above the ground level at main stem from tagged plants in all the treatments and expressed in cm. Total number of leaves present at the seedlings were recorded at 15, 30, 45 DAS interval. The root-shoot ratio is usually given as the ratio of the weight of the roots to the weight of the top of a plant. Root volume of the seedling was measured at 15, 30, 45 DAS.The volume was calculated using the following formula= **d^2h cubic cm.** Where d is the diameter of the stem of seedling and h is the height of seedling .d – Diameter was calculated from, $G = 2\pi r$, G – Girth ,Dividing Girth by, we can get the diameter, $d = G \div \pi$.

Results and Discussion

1. Seedling height (cm):

The results revealed that the height of seedling was influenced by foliar spray of fermented fish and chicken waste (Table 1) The height of the seedling was significantly superior (35.50) in 1% fermented chicken waste after spray of 15, 30, 45 DAS. The incremental plant height was recorded higher in 1% fermented chicken waste spray (14.67 cm). It was on par with 2% fermented fish waste after spray of 15, 30, 45 DAS . The lower plant height was recorded in control treatment (17.33, 18.33, 20.67, 20.83), respectively. These results are in accordance with the findings of Priyanka *et al*. (2019b) in rice. Abbasi *et al*. (2003) in tomato. Mmbaga *et al*, (2014) have reported that the increase in chlorophyll always improves the absorption capacity and improves the photosynthetic ability, growth and yield of green gram. The mesophyll cells are involved in the capture of light and the spongy mesophyll cells aid in regulating the gas exchange and it increases the photosynthesis and growth of seedlings. The chlorophyll free tissues, the bundle sheath extensions like parenchyma, sclerenchyma enhance not only provides mechanical support and water conduction but they also increase the light environment in the deeper regions of the mesophyll.

2. Seedling Stem Girth (cm):

The results revealed that the stem girth was influenced by foliar spray of fermented fish and chicken waste.(Table 2)The stem girth of the seedling was significantly superior (2.40) in 1% fermented chicken waste after spray of 15,30, 45 DAS. The incremental stem girth was recorded higher in 1% fermented chicken waste spray (0.94cm). It was on par with 2% fermented fish after spray of 15, 30, 45 DAS. The lower stem girth was recorded in control treatment (1.37, 1.4, 1.43, 1.46), respectively. FFW and FCW combination had higher nutrients and proteins; it may affect the seedling growth. These results are in accordance with the findings of Gasana *et al* ,(2020) in water melon plants. The application of 2% FFW, 1% FCW had a positive effect on plant growth. These results are in accordance with the findings Ramesh *et al*. (2020) in amaranths crop. The increase in leaf area and augmentation of photosynthetic pigments in FFW and FCW plants were echoed in the photosynthetic process and hence an increase in the carbohydrate content.

3. Number of Leaves:

The no of leaves was influenced by foliar spray of fermented fish and chicken waste. (Table 3)The no of leaves of the seedling was significantly superior (38.67) in 1% fermented chicken waste after spray of 15, 30, 45 DAS. The incremental no.of.leaves was recorded higher in 1% fermented chicken waste spray (30.50). It was on par with 2% fermented fish after spray of 15, 30, 45 DAS. The lower no of leaves was recorded in control treatment (7.33, 7.53, 7.70, 8.17), respectively. These results are in accordance with the findings of Gasana *et al*. (2020) in water melon plants. The application of 2% FFW, 1% FCW had a positive effect on plant growth. Karim et al, (2005) also reported similar conclusions when the application of liquid fish silage increased the photosynthetic pigments. The increased amount of carotenoids and chlorophyll (xanthophylls) in FFW and FCW serves as protecting filters of light involved in the transfer of energy and light. The increased amount of carotenoids in protects the chlorophylls and thylakoid membrane from photo oxidation induced damage in *Brassica*. These results are in accordance with the findings Ramesh *et al*. (2020) in amaranthus crop.

4. Root Shoot ratio (cm):

The results revealed that the root shoot ratio was influenced by foliar spray of fermented fish and chicken waste.(Table 4)The root shoot ratio of the seedling was significantly superior (0.61) in 1% fermented chicken waste after spray of 15, 30, 45 DAS. The incremental root shoot ratio was recorded higher in 1% fermented chicken waste spray (0.19cm).It was on par with 2% fermented fish after spray of 15, 30, 45 DAS .The lower root shoot ratio was recorded in control treatment (0.49, 0.50, 0.51, 0.53), respectively. These results are in accordance with the findings of Gasana *et al.(*2020*)* in water melon plants. The application of 2% FFW, 1% FCW had a positive effect on root shoot ratio. These results are in accordance with the findings Ramesh *et al*.(2020) in amaranthus crop.

5. Root Volume (cc):

The results revealed that the root volume was influenced by foliar spray of fermented fish and chicken waste. (Table 5)The root volume of the seedling was significantly superior (12.97) in 1% fermented chicken waste after spray of 15, 30, 45 DAS. The incremental root volume was recorded higher in 1% fermented chicken waste spray (8.47cc). It was on par with 2% fermented fish after spray of 15, 30, 45 DAS. The lower root volume was recorded in control treatment (4.0, 4.13, 4.33, 4.50), respectively. The application of 2% FFW, 1% FCW had a positive effect on plant growth. These results are in accordance with the findings priyanka *et al*. (2019a) in green gram crop.

Economics:

If one rupee was invested, a nursery producer can get 1.52 rupees from this method of spray. Hence, this method would be a positive net gain to the producer and also recommend fermentation of chicken waste *viz.*, intestine (unconsumable) waste as well as fish waste.

Conclusion:

Foliar application of 1% Fermented chicken waste registered significantly higher growth parameters in kapok seedling than other treatments. It was on par with 2% Fermented fish waste. Foliar spray of 1% Fermented chicken waste could be recommended as liquid organic input to get higher growth of seedling as a booster.

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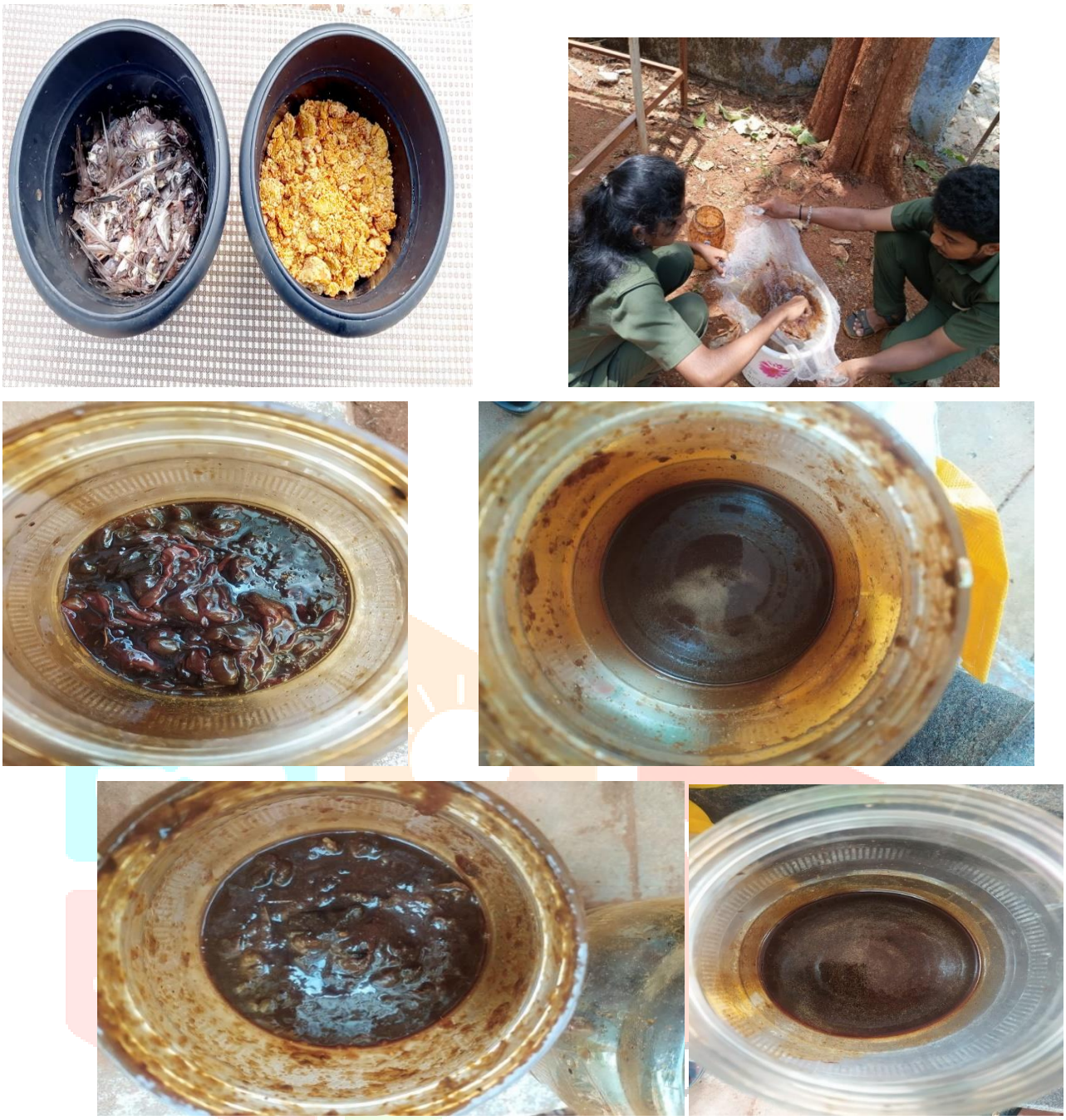

Figure 1. Fermentation procedure of Fish and Chicken wastes

Table 1. Effect of fermented fish and chicken waste sprays as influenced on seedling height (cm).

Treatment	Before spray	After 15 days spray	After 30 days spray	After 45 days spray	Incremental plant height over control after spray
T_1 -1% Fermented fish waste	18.21	26.00	28.00	32.33	11.50
T_2 -1% Fermented chicken waste	17.60	29.00	32.33	35.50	14.67
T_3 -1%Fermented fish and chicken waste	18.52	23.00	27.67	30.00	9.17
T_4 -2% Fermented fish waste	18.31	27.67	30.33	33.00	12.17
T_5 -2% Fermented chicken waste	17.90	27.75	31.50	33.83	13.00
T6-2% Fermented fish and chicken waste	18.60	21.33	24.50	27.67	6.84
T_7 -3% Fermented fish waste	18.40	25.00	27.00	28.67	7.84
T_8 -3 % Fermented chicken waste	18.30	24.33	23.17	30.33	9.50
T9-3% Fermented fish and chicken waste	17.40	23.67	26.00	29.33	8.50
T_{10} – Control	17.30	18.33	20.67	20.83	
SEd	**2.82**	**1.67**	**2.67**	**1.88**	
CD(p=0.05)	**NS**	**3.59**	**5.72**	**4.04**	

Table 2. Effect of Fermented fish and chicken waste spray as influenced by stem girth (cm).

Treatment	Before spray	After 15 days spray	After 30 days spray	After 45 days spray	Incremental stem girth over control after spray
T_1 -1% Fermented fish waste	1.41	1.50	1.77	2.17	0.71
T_2 -1% Fermented chicken waste	1.44	1.77	2.03	2.40	0.94
T_3 -1%Fermented fish and chicken waste	1.40	1.43	1.73	1.93	0.47
T_4 -2% Fermented fish waste	1.51	1.63	1.97	2.23	0.77
T_5 -2% Fermented chicken waste	1.42	1.71	1.99	2.29	0.83
T6-2% Fermented fish and chicken waste	1.49	1.67	1.73	1.83	0.37
T_7 -3% Fermented fish waste	1.46	1.83	1.87	2.27	0.81
T_8 -3 % Fermented chicken waste	1.48	1.57	2.13	2.57	1.11
T9-3% Fermented fish and chicken waste	1.47	1.80	1.77	2.03	0.57
T_{10} – Control	1.37	1.40	1.43	1.46	
SEd	**0.11**	**0.14**	**0.13**	**0.13**	
CD(p=0.05)	**NS**	**0.31**	**0.28**	**0.29**	

Table 3.Effect of fermented fish and chicken waste spay as influenced by number of leaves.(no's)

Treatment	Before spray	After 15 days spray	After 30 days spray	After 45 days spray	Incremental no.of.leaves over control after spray
T_1 -1% Fermented fish waste	7.43	17.67	26.67	29.33	21.16
T_2 -1% Fermented chicken waste	8.33	24.00	33.67	38.67	30.50
T_3 -1%Fermented fish and chicken waste	7.87	10.00	16.00	18.67	10.50
T_4 -2% Fermented fish waste	8.27	22.00	30.33	36.67	28.50
T_5 -2% Fermented chicken waste	7.83	20.00	28.67	33.00	24.83
T6-2% Fermented fish and chicken waste	7.90	16.00	12.00	15.00	6.83
T_7 -3% Fermented fish waste	8.17	18.67	29.33	34.00	25.83
T_8 -3 % Fermented chicken waste	7.60	13.67	22.67	26.33	18.16
T9-3% Fermented fish and chicken waste	7.50	16.33	17.67	19.00	10.83
T_{10} – Control	7.33	7.53	7.70	8.17	
SEd	**2.54**	**3.21**	**3.20**	**3.21**	
CD(p=0.05)	**NS**	**6.89**	**6.87**	**6.88**	

Table 4.Effect of fermented fish and chicken waste spay as influenced by root shoot ratio (cm).

Treatment	Before spray	After 15 days spray	After 30 days spray	After 45 days spray	Incremental root shoot ratio over control after spray
T_1 -1% Fermented fish waste	0.53	0.55	0.56	0.57	0.15
T_2 -1% Fermented chicken waste	0.52	0.57	0.58	0.61	0.19
T_3 -1%Fermented fish and chicken waste	0.54	0.48	0.49	0.51	0.09
T_4 -2% Fermented fish waste	0.51	0.53	0.56	0.59	0.17
T_5 -2% Fermented chicken waste	0.50	0.50	0.53	0.55	0.13
T6-2% Fermented fish and chicken waste	0.53	0.48	0.50	0.54	0.12
T_7 -3% Fermented fish waste	0.52	0.50	0.51	0.52	0.10
T_8 -3 % Fermented chicken waste	0.50	0.49	0.51	0.53	0.11
T9-3% Fermented fish and chicken waste	0.51	0.48	0.50	0.52	0.10
T_{10} – Control	0.40	0.42	0.44	0.42	
SEd	**0.03**	**0.02**	**0.01**	**0.03**	
CD(p=0.05)	**NS**	**0.04**	**0.03**	**0.06**	

Table5.Effect of fermented fish and chicken waste spay as influenced by root volume (cc).

Treatment	Before spray	After 15 days spray	After 30 days spray	After 45 days spray	Incremental root volume over control after spray
T_1 -1% Fermented fish waste	4.87	6.47	9.27	9.40	4.90
T_2 -1% Fermented chicken waste	4.70	8.33	12.50	12.97	8.47
T_3 -1%Fermented fish and chicken waste	4.47	5.40	10.13	10.23	5.73
T_4 -2% Fermented fish waste	4.40	8.17	11.91	12.57	8.07
T_5 -2% Fermented chicken waste	4.45	8.0	10.20	11.17	6.67
T6-2% Fermented fish and chicken waste	4.67	7.23	7.40	8.00	3.50
T_7 -3% Fermented fish waste	4.37	8.40	10.10	10.57	6.07
T_8 -3 % Fermented chicken waste	4.73	7.47	7.53	8.13	3.63
T9-3% Fermented fish and chicken waste	4.60	6.53	11.20	12.03	7.53
T_{10} – Control	4.00	4.13	4.33	4.50	
SEd	**0.68**	**0.93**	**1.68**	**2.43**	
CD(p=0.05)	**NS**	**1.99**	**3.61**	**5.22**	