Ijeas Ideal Journal of Engineering and Applied Sciences 2(1) 18-20 Ijeas
© Ideal True Scholar (2016) (ISSN: 2067-7720)
http://ijeas.truescholar.org

EVALUATION OF SEED CAKE AND FERMENTED SLURRY OF *JATROPHA* SEED AS BIO-FERTILIZER

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ABSTRACT
The objectives of this study were to evaluate the seed cake and fermented slurry of *Jatroph*a seed as bio-fertilizer. The chemical analyses showed that the seed cake has 6.3% nitrogen, 0.9% phosphorus and 1.2% potassium. While fermented slurry showed 6.65% nitrogen, 5.3% phosphorus and 0.71% potassium. The Fermentation increased nitrogen content from 6.3 to 6.65 and Phosphorus from 0.9 to 5.3 while the potassium was decreased from 1.2 to 0.71. It is obvious that fermentation of seed cake resulted in substantial increase of phosphorus. The seed cake and fermented slurry of Jatropha seed were tested as bio-fertilizer. Similar doses of both Seed cake and fermented slurry were used (5, 10 and 20t/hectare). Both components were tested using sorghum plants. The bio-fertilizers were applied 30 days after sowing. The higher doses of the seed cake resulted in complete loss of the sorghum plants. There is no difference between the control and the lower doses. On the other hand the fermented slurry caused an increase in number of leaves stem diameter and plant height. It could be concluded that the toxicity of seedcake can be removed by fermentation. Microbiological investigation indicated that the microorganisms involved in the fermentation process were *Bacillus and Lactobacillus bacteria.*

KEYWORDS: seed cake, *Jatroph*a seed, bio-fertilizer, chemical analyses

INTRODUCTION
Seed cake or press cake is a byproduct of oil extraction from Jatropha seeds. *Jatropha* Seed cake contains curcin, a highly toxic protein similar to ricin in castor, making it unsuitable for animal feed. However, it does have potential as a fertilizer or substrate for biogas production [3]. The defatted meal has been found to contain a high amount of protein in the range of 50–62%, and the level of essential amino acids except lysine is higher than the FAO reference protein Makkar *et al*., (1998). Being rich in nitrogen, the seed cake is an excellent source of plant nutrients. In a green manure trial with rice in Nepal, the application of 10 tones of fresh physic nut biomass resulted in increasing yield of many crops Sherchan *et al.,* (1989).

Experiments on use of biogas slurry as a fertilizer are still in the early stages. Recently experimentation on solid-state fermentation of *Jatropha* seed cake showed that, it could be a good source of low cost production of industrial enzymes Mahanta *et al*., (2008). Due to toxicity, seed cake can neither be used as animal feeding nor in agricultural farming**.**

METHODOLOGY
The Chemical Determination of Seed Cake and Slurry
The chemical composition of seed cake and slurry of seed cake was determined following AOAC methods. The minerals were determined according to Chapman and Pratt, (1961).

BIOCHEMICAL TEST
Slurry samples were taken and cultured on Nutrient Agar. The bacterial colonies obtained were subjected to different biochemical tests.

EXPERIMENTAL SITE AND DESIGN
An experiment was carried out at Botanical Garden, Faculty of Agriculture, University of Khartoum. The experiment carried out in CRD with 3 replicates. Both seed cake and digested slurry were applied each in 3 doses, 5, 10 and 20t/ha. The treatments were applied one month after sowing. Sorghum plants were sown in pots containing sterilized soil. Measurement of parameters (number of leaves, stem diameter and plant height) was carried out twice. The first reading was done 7 days after the application of the treatments and the second after 14 days.

RESULTS AND DISCUSSION

The chemical analysis showed that the nitrogen content of the digested slurry was slightly higher than the seed cake. With regard to potassium content the seed cake has high potassium content compared to the fermented slurry. The fermented slurry contained very high phosphorus which was six times that of the seed cake (**Error! Reference source not found.**). The possibility of using seed cake and fermented slurry as bio-fertilizers was investigated using sorghum plants. Both components were applied at similar rates. The higher seed cake treatments (10 and 20 t/h) resulted in complete death of the sorghum plants after 7 days. In case of the lower dose of seed cake (5t/h) the number of leaves, stem diameter and plant height remained constant and less than both control and fermented slurry treatments throughout the experiment period. The addition of fermented slurry resulted in high number of leaves, thick stem and taller plants. No significant differences were observed between digested slurry treatments but the highest dose gave the least values in comparison with the lower and intermediate doses after 7 days. After 14 days both the lower and the highest doses of digested slurry gave high number of leaves and taller plants (Table 2 and Table 3) and (**Error! Reference source not found.**, Plate 2 and Plate 3). Many researchers reported that the Jatropha seed cake is toxic to both plants and animals (Gollakota, and Jayalakshmi, 1983 and Nwosu and Okafor, 1995). The seed cake can neither be used as animal feed nor in agricultural farming due to this toxicity, (Staubman *et al.*, 1997 and Gubitz *et al.*, 1999). Jatropha Seed cake contains curcin, a highly toxic protein similar to ricin in castor making it unsuitable for animal feed. Sherchan *et al.,* (1989) stated that the application of 10 tones of Jatropha seed cake resulted in increasing yield of many crops. In order to utilize this seed cake the toxicity must be removed. One of the ways to remove the toxicity is through fermentation to produce biogas and to use the digested slurry as bio-fertilizer. Gollakota and Jayalakshmi, (1983) stated that the generation of biogas from seed cake is a best solution for its efficient utilization. The biodigestion of seed cake by fermentation process indicated an increase in both nitrogen and phosphorus and a decrease in the potasssium. Raheman and Modal, (2012) reported that the biodigetion of JSC resulted in an increase in ntirogen content while both phosphorus and potassium remained unchanged. They attributed that to decomposition of protein. Our finding agreed partially with this result a far as nitrogen is concerned and diagreed in case of phosphorus which was increased after biodigestion of the JSC. It is worth mentioning that the phosphorus content of the seed cake increased almost by 30% compared with the phosphorus content of the seed. After fermentation the phosphorus content was increased enormously compared to the phosphorus content of both seed and seed cake. This increase in the phosphorus content after fermentation may be due to the microorganisms involved in the fermentaion process.

CONCLUSIONS

- The Jtropha seed cake can not be used directly as bio-fertilizer.
- The toxicity of Jatropha seed cake can be removed by fermentation.
- The biodigestion of JSC increased nitrogen and phosphorus contents

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APPENDIX

Table 1: The chemical composition of seed cake and slurry

Parameters	N %	P%	K %
Seed cake	6.3	0.9	1.1
Slurry	**6.65**	**5.3**	**0.71**

Table 2: Means of plant parameters number of leaves stem diameter and plant height (cm) after **7** days.

Parameters	Numbers of leaves(cm)	Stem diameter(cm)	Plant Height (cm)
JSC1	6	3.3	42
JSC2	0	0	0
JSC3	0	0	0
SL1	8	3	53
SL 2	8	3.7	68.7
SL 3	6	2	38.3
Control	7	2.3	61.7

Where
JSC1= 5 Tons/hectare.
JSC2 = 10 Tons/hectare.
JSC3= 20 Tons/hectare.
SL1= 5 Tons/hectare.
SL2= 10 Tons/hectare.
SL= 20 Tons/hectare

Table 3: Means of plant parameters number of leaves stem diameter and plant height (cm) after 14 days.

Parameters	Numbers of leaves(cm)	Stem diameter(cm)	Plant Height(cm)
JSC1	6	3.3	65
JSC 2	0	0	0
JSC 3	0	0	0
SL 1	10	4.7	84.3
SL 2	8	3.7	73
SL 3	8.	4.3	78
Control	7	2.3	68

Table 4 : Mean number of leaves ,stem diameter and plant heighest of Sorghum.

Treatments	No. of Leaves	Stem dimeter	Plant heighest
Control	7.7ab	3.7ab	68.00ab
JSC 5	9.0ab	4.00ab	65.00ab
JSC 10	0.00c	0.00c	0.00c
JSC20	0.00c	0.00c	0.00c
SL5	10ab	4.7ab	84.40ab
SL 10	8ab	4.4ab	73.00ab
SL 20	10ab	4.4ab	79.4ab

Means with same letter in each column were not significantly different (P<0.05).

Plate 1 :The effect of different doses of SL (5, 10 and 20 t/ha).

Plate 2 : The effect of different dozes of JSC (5, 10 and 20 t /ha on sorghum

Plate 3: The effect of different doses of SL (5, 10 and 20 t /ha) compared to the control.