EFFECT OF PALM BUNCH ASH ON THE SEED GERMINATION, SEEDLING GROWTH AND BIOCHEMICAL PARAMETER OF SOYBEAN

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ABSTRACT
The work was carried out to study the effects of Palm Bunch Ash (PBA) on seed germination, seedling growth and biochemical parameters of Soybean. Soybean seeds were raised in petri-dishes and irrigated with different concentrations of PBA (0-control, 10, 25,40,65,80 and 100%). At lower concentrations, PBA had promotory effects on all the parameters studied while 100% concentration had inhibitory effects.

Key words: Palm Bunch Ash, Soybean, Germination, Biochemical Parameters.

INTRODUCTION
Palm bunch ash (PBA) increases the number of symbiotic and non-symbiotic bacteria which add more nutrients to the soil and thereby increase plant yield (Omoti et al, 1991). Ekwuribe et al (2008) reported an increase in the number of functional nodules in cowpea treated with palm bunch ash. Ike (2008) noted a reduction in the leaf area of *Arachis hypogeae* when high concentrations of palm bunch ash were added to the soil while lower concentrations were found to have a promotory effect. In Nigeria, as commercial fertilizers are very expensive and financial resources severely limited attention should be focused on locally available materials capable of being used as fertilizers. Awareness of the benefits of applying agricultural and agro-industrial residues on crop production is increasing (Toh et al, 1983). Oil palm bunch is one such local residue. It is available in raw decomposed or bunch ash form. Palm bunch ash is cheap, convenient and easy to apply. Palm bunch ash is very hygroscopic, extremely basic and contains potassium, calcium, magnesium and phosphorus (Safo *et al*, 1997; Arokiasamy, 1967). This work studied the effects of PBA on seed germination, seedling growth and biochemical parameters of soybean in furtherance of the search for locally available materials that can effectively serve as fertilizers considering the above properties of PBA.

MATERIALS AND METHODS
The Soybean seeds used in this study were surface sterilized by dipping in 10% sodium hypochloride solution for 10 minutes and rinsed with distilled water. Twenty seeds were placed in sterilized petridishes, lined with different concentrations of PBA and distilled water. The petri-dishes were irrigated with different concentrations of PBA. The number of germinated seeds was counted from the 4^{th} day of germination and the total percentage germination was calculated. Data were taken from four replicates of seedlings on the six-day old seedlings. Six-day-old seedlings of soybean were separated into root and shoot and used for the estimation of chlorophyll, carotenoid, sugars, protein, starch and amino acid contents.

RESULTS AND DISCUSSION
Lower concentrations of PBA had promotory effects on seed germination, seedling growth, fresh and dry weights of soybean. The promontory effect was found to increase with increase in the concentration of PBA up to 40%, above which, the effect became inhibitory (Table I). Maximum promotory effect was achieved at 40% concentration. The promotory effects of lower concentration of PBA on the parameters studied may have resulted to improved soil fertility as palm bunch ash is known to contain a number of mineral nutrients

that promote growth (Ogu, 2009). Percentage germination and seedling growth were inhibited at 80 and 100% concentration of PBA (Table I). This inhibitory effect may be due to high osmotic pressure which makes inhibition difficult resulting to retarded growth and low germination percentage.

Photosynthetic pigments (chlorophylls, carofenoids) and total sugars increased with increase in the concentration of PBA with 40% giving the highest value (Table 2). This increase may be attributed to high nutrient uptake, synthesis and translocation probably facilitated by optimum availability of iron and magnesium in the soil treated with PBA. This corroborates the findings of Isirimah et al (1989) that adequate amount of organic matter and nutrient elements contained in PBA are eventually released into the soil as the PBA is degraded. Starch, protein and amino acid contents of the root and shoot increased as the concentration of PBA increased up to 40%. Thereafter, there was a decrease in the starch, protein and amino acid contents (Table 3). The increase observed in the crude protein content might be due to increased rate of amino acid synthesis attributable to higher rates of both RNA-ase and transaminase activity (Singh, 1991). The decreased starch content of both the root and shoot at 100% concentration of PBA could possibly be that there was lowered activity of phosphorylase and increased activity of betamylase and invertase. This agrees with the observation of Oba (2005) that high concentrations of PBA are inhibitory to plant growth and development. The result of this study shows that soil fertility could be improved by the application of low concentrations of PBA.

CONCLUSION

Palm bunch ash is proved by this study to increase the growth and biochemical parameters of soybean at low concentrations up to 40%. Considering the promotory effects observed in this study, PBA is recommended as an alternative to commercial fertilizers which are expensive.

Table 1: Effect of PBA on the percentage germination, seedling growth, fresh and dry weights of soybean

PBA Concentration (%)	Germination Percentage	Seedling growth cm/seedling	Fresh weight g/seedling	Dry weight g/seedling
Control	85 ± 0.015	15.2 ± 0.041	1.28 ± 0.014	0.28 ± 0.020
10	90 ± 0.018	15.5 ± 0.053	1.59 ± 0.022	0.54 ± 0.032
25	97 ± 0.020	16.3 ± 0.033	1.70 ± 0.036	0.57 ± 0.039
40	100 ± 0.034	16.3 ± 0.054	1.98 ± 0.032	0.79 ± 0.035
65	88 ± 0.030	16.0 ± 0.059	1.71 ± 0.044	0.60 ± 0.036
80	84 ± 0.028	15.2 ± 0.045	1.56 ± 0.052	0.48 ± 0.029
100	72 ± 0.022	14.4 ± 0.042	1.19 ± 0.010	0.25 ± 0.022

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Table 2: Effect of PBA on photosynthetic pigments and total sugar content in soybean

PBA Concen-tration (%)	Chlorophyll a	Chlorophyll b	Total Chlorophyll	Carotenoids	Total Sugar	
					Root	Shoot
Control	0.672 ± 0.0115	0.661 ± 0.0521	1.433 ± 0.051	0.423 ± 0.014	5.214 ± 0.0142	6.314 ± 0.0121
10	0.715 ± 0.0112	0.705 ± 0.0112	1.420 ± 0.514	0.512 ± 0.014	5.435 ± 0.0134	7.434 ± 0.0106
25	0.745 ± 0.0121	0.726 ± 0.0134	1.471 ± 0.047	0.545 ± 0.010	6.145 ± 0.0123	8.242 ± 0.0130
40	0.824 ± 0.0102	0.804 ± 0.0104	1.628 ± 0.042	0.621 ± 0.009	7.132 ± 0.0116	9.411 ± 0.0412
65	0.739 ± 0.0109	0.719 ± 0.0171	1.458 ± 0.044	0.546 ± 0.013	6.146 ± 0.0125	8.312 ± 0.0101
80	0.702 ± 0.0114	0.642 ± 0.0114	1.344 ± 0.051	0.504 ± 0.014	5.441 ± 0.0012	7.413 ± 0.0112
100	0.615 ± 0.0125	0.607 ± 0.0140	1.222 ± 0.054	0.434 ± 0.0142	5.243 ± 0.023	6.142 ± 0.0134

Table 3: Effect of PBA on starch, protein and amino acid content in soybean

PBA Concentration (%)	STARCH		PROTEIN		AMINO ACID	
	ROOT	SHOOT	ROOT	SHOOT	ROOT	SHOOT
Control	0.224 ± 0.034	0.231 ± 0.024	1.106 ± 0.88	1.660 ± 0.096	4.126 ± 0.032	3.142 ± 0.034
10	0.253 ± 0.032	0.259 ± 0.021	1.542 ± 0.078	1.364 ± 0.102	4.822 ± 0.024	3.454 ± 0.027
25	0.314 ± 0.029	0.264 ± 0.020	1.905 ± 0.064	1.786 ± 0.095	5.456 ± 0.022	4.342 ± 0.018
40	0.334 ± 0.024	0.275 ± 0.018	2.143 ± 0.049	1.921 ± 0.062	6.212 ± 0.014	5.434 ± 0.016
65	0.297 ± 0.013	0.267 ± 0.019	1.981 ± 0.056	1.654 ± 0.074	5.425 ± 0.021	4.332 ± 0.029
80	0.243 ± 0.034	0.254 ± 0.022	1.546 ± 0.084	1.149 ± 0.087	4.362 ± 0.028	3.440 ± 0.032
100	0.214 ± 0.0137	0.226 ± 0.010	1.097 ± 0.026	0.984 ± 0.013	3.104 ± 0.036	3.046 ± 0.040