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THE EFFECT OF BURNING BUSH AT DIFFERENT HOURS AFTER SLASHING ON SELECTED SOIL CHEMICAL PROPERTIES.

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ABSTRACT

Bush burning in Africa and in fact major areas of the tropical world has been an age long practice for land clearing and preparation. Although the negative effects of bush burning has been recognised it still appears to be the cheapest means of land clearing to which an acceptable alternative has not been found. The study looked into burning the bush at different time after slashing. The effects of the time difference on the soil chemical properties were then investigated. Burning the bush increased the soil Ph, available exchangeable cations and phosphorus. However, the amount of soil organic matter and total nitrogen content was significantly increased.

The study suggests that if bush burning must be done at all, it should occur twenty-four hours after slashing.

Key words: Bush burning, Slashing, Soil Chemical Properties.

INTRODUCTION

In most parts of tropical Africa and the rest of the tropical world, bush burning is an annual ritual during land clearing and preparation exercises. The reasons adduced for this include the very low cost of bush burning compared to the other methods of bush clearing. Besides, during the bush burning exercise the farmer hunts for games and derives nutrient addition to the soil in form of ash (Obatolu, 1991). Various investigations in Nigeria have been done on the effects of bush burning in different ecological zones (Cook, 1939; Griffiths, 1971; Moor, 1960; Nwoboshi, 1972; Agboola and Fagbenro, 1985). All these studies have highlighted the loss of nitrogen, sulphur and most importantly soil organic matter. Although theses losses are great, the farmer does not see any reason why he should not use fire for land clearing. Moreover, the advantages of bush burning such as improvement in soil physical conditions such as better workability, increase water infiltration (Fagbenro, 1982) are so evident. Earlier investigations also reported improvement in the structure of the top 1 or 2cm of soil as a result of bush burning (Nye and Greenland, 1960). Moor (1960) reported an increase of 17% in the humus contents of the upper 20cm of the soil in the Nigerian derived savanna after 30 years of annual burning, while Nwoboshi (1972) reported increase in soil P.K. and Ca. These and the added advantage of the cheap cost of clearing through burning makes it a difficult task to discourage the tropical farmer from using it. Afolayan, (1977) noted that the effect of burning on soil properties is very much dependent on whether the burning is done early or late in the dry season.

This study looked into the effect of the time lag between slashing and burning on soil chemical properties. The aim is to find out the appropriate time to burn if it is unavoidable to burn.

MATERIALS AND METHODS

The study was carried out in Ibadan (L at 07°10'N and longitude 03°52'E) at the premises of the Cocoa Research Institute of Nigeria.

The soil used in an Alfisol which according to Ojo-Atere *et. al.* (1987) is an oxic tropudalfts. It is usually farmed to maize, cassava and plantain, but has been left to follow for three consecutive years before the study.

About 200m² of plot was slashed for each treatment, while each treatment was replicated four times. The treatments were as follows:

(i) The weeds slashed and soil sample obtained same day without burning to serve as the control.

(ii) The weeds slashed and left for 24 hours before burning and thereafter soil sample taken.

(iii) The weeds slashed and left for 48 hours before burning and thereafter soil sample taken.

(iv) The weeds slashed and left for 72 hours before burning sample collection.

The predominating weeds were *Chromoleana odorata* (siam weed) and . *Pennisetum purpureum* (elephant grass).

The study was carried out in January during the dry season. The temperature during this time averaged 30°C, and the relative humidity 50%. There was no rainfall during the period.

Top soil sample (0 - 30cm layer) was collected randomly from each plot with the aid of a soil auger. Sample from the different replicates of a treatment were bulked air dried and sieved through 2mm sieve.

The sample were then analysed as follow

(i) Ph was determined in water (1:2 soil: water ratio) using a Ph- meter with glass electrode;

(ii) Total nitrogen using the macro-kjedhal procedure as described by Jackson, (1958);

(iii) Organic carbon content using the Walkey-Black method as described by Walkey and Black, (1934);

(iv) Organic matter content was obtained by multiplying the value for the organic carbon by 1.724;

(v) Available phosphorus was determined using the Bray No. 1 method described by Bray and Jurth, (1945).

(vi) Exchangeable cations were determined with 1N ammonium acetate solution. The contents of K, Ca, and Na in the filtrate were then determined using a corning flame photometer with appropriate filter, Mg was determined using a Perkin Elmer Atomic Absorption Spectrophotometer model 704.

RESULTS AND DISCUSSION

Soil Ph was significantly increased as a result of burning (Table 1). There was no significant difference in the Ph of soils from plot where the weed were burnt after 24 hours or 48 hours. When the weed were burnt after 72 hours of slashing, soil Ph increased significantly (1.9 units). The results obtained in this study agree in part with the earlier report of Nye and Greenland (1960) who found only insignificant (0.2 units) increase in soil pH after burning in a savannah ecosystems. The longer the drying period of the weed before burning, the higher the soil pH. The results obtained are believed to be tied to the resultant basic cation in the soil after burning (Table 1).

Results of the soil analysis also show as presented in Table 1, that burning increased the soil content of exchangeable cations. While the increase in the amount of exchangeable Na and Mg were significant those of K and Ca were not significant. The study showed that the longer the drying period before burning, the higher the level of exchangeable cation in the soil. This apparently is as a result of total burning of the materials after long hours of drying and the release of the cations stored in them. The study agree with the reports of Nwoboshi (1972). In a similar study Afolayan (1977) observed increase in soil base saturation when bush was burnt late in the dry season.

As shown in Table 1, available phosphorus in soils from plots where the weeds burnt were significantly higher than the control. The longer the drying period of the weeds before burning, the higher the available phosphorus content of the soil. Even though the phosphorus content of the plots with 72 hours drying period were higher than the 24 hours and 48 hours periods, the differences were not significant.

Soil total nitrogen as affected by the different treatments are presented in figure 1. There was a 40% reduction soil nitrogen content as a result of burning. The loss of nitrogen increased as the period of drying became longer.

Thus after 72 hours of drying soil nitrogen lost after burning rose significantly. This study

is in tune with that of Kadeba, (1982) who recorded a 35.38% loss in soil nitrogen as a result of burning savanna forest in Nigeria. The loss in nitrogen as a result of burning is due to volatilization which increases as the burning temperature increases. This therefore explains the increase in nitrogen loss as the drying period of the burnt material increased.

In figure 2, the soil content of organic matter (organic C x 1.724) is presented. Soil organic carbon increased as a result of burning. Similarly the soil organic matter content increased. The result obtained here agree with the observation made by Moore (1960), that there was a 17% increase in soil humus as a result of 30 years of annual burning in the Nigeria Savanna area. The materials consumed by fire are the unhumified rests of plants and animals which under normal analytical conditions are sieved away from the soil. Thus these materials are not normally represented in the determination of soil organic carbon through the Walky and Black method used in this study. After burning, the unhumified materials are turned in ash/charcoal which can pulverise and therefore now determined in the soil. Consequent to this, soil organic carbon content and from it, the organic matter content can increase. This increase is however to be viewed against the background of the mindered quality of the organic matter.

CONCLUSION

The study has shown that burning when done early does not have too much adverse effects on soil chemical properties. Organic carbon content of the soil could be increased by burning but only as charcoal which could degrade slowly, and contain very little nutrient elements on their own. Since there is no cost effective alternative to burning, the farmer could clear his farm by burning early.

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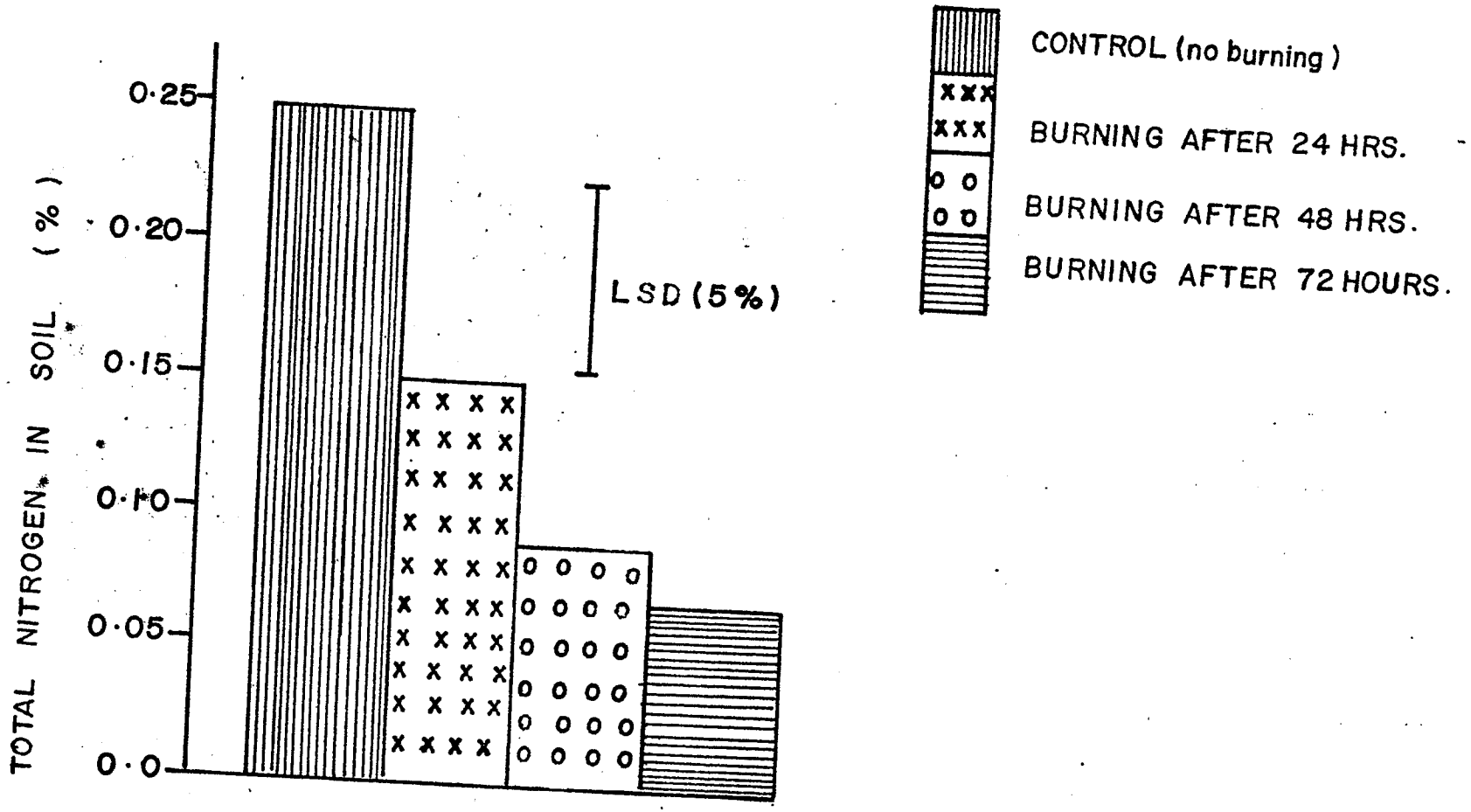
Table 1: The Effect of Bush- burning at Different Times After Slashing on Selected Soil Chemical Properties at 0 - 30cm depth.

Treatment (Hours of drying before burning)	pH (H_2 0	Exchangeable cation in soil meq/100				Avail P (ppm)
		Na	K	Mg	Ca	
24 Hours	7.70	o.27	1.50	3.08	4.16	44.21
48 hours	7.80	0.31	2.76	3.69	7.85	45.31
72 hours	8.00	0.30	2.70	4.17	9.12	51.91
Control	6.10	0.60	1.62	1.44	6.20	32.45
LSD(5%)	1.21	0.03	1.42	1.64	2.96	11.15



Fig·1: The effect of Bush-burning at different times after slashing on soil nitrogen content.

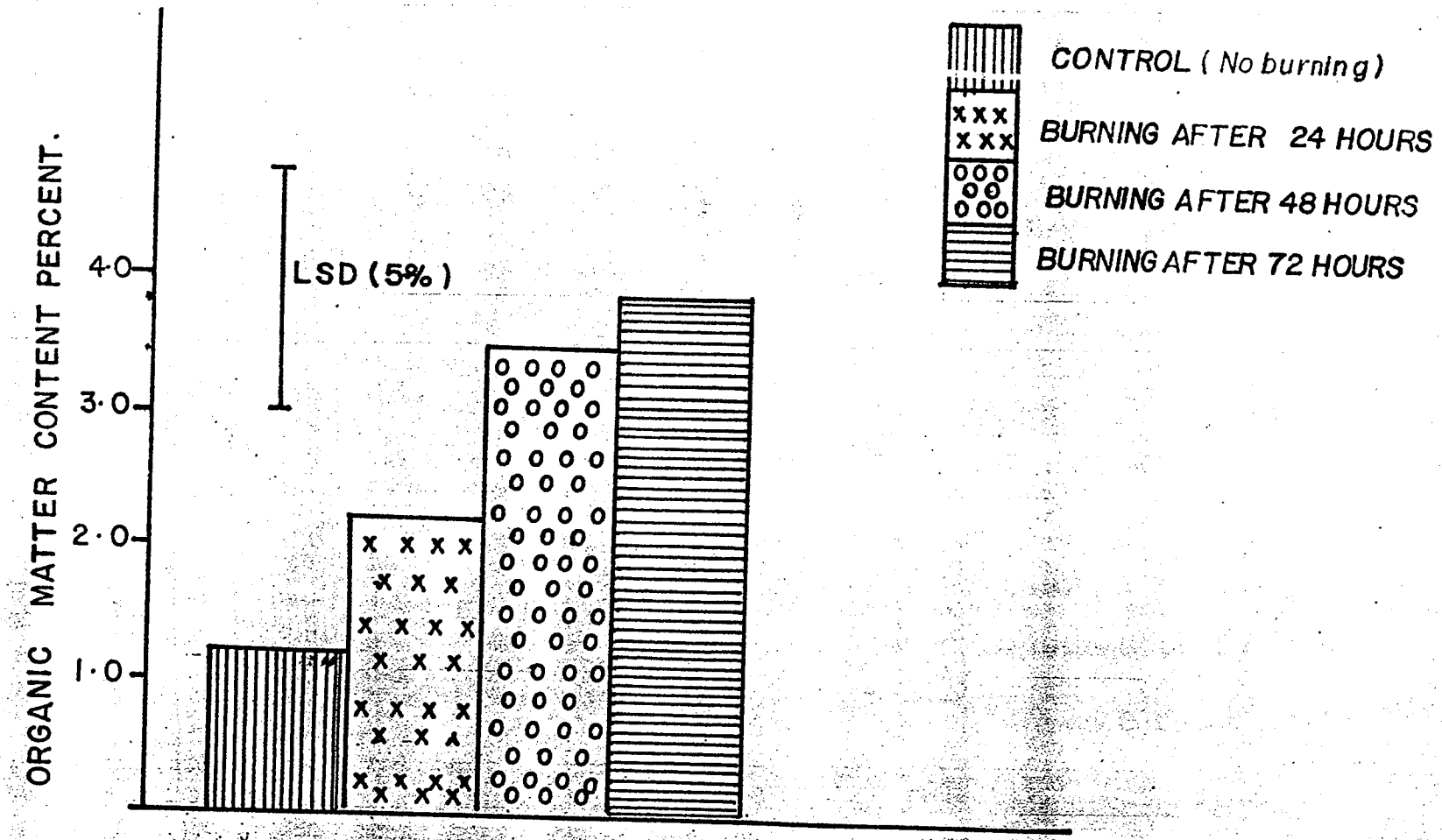


Fig. 2: The effect of Bush-burning at different times after slashing on soil organic matter content.