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EFFECTS OF DIFFERENT CASSAVA CROPPING PATTERNS ON SOIL FERTILITY, CROP YIELDS AND FARM INCOME

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SUMMARY

A cassava cropping systems trial was conducted in Caicedonia, Colombia, on a degraded Andosol with a history of five previous cassava crops. Starting 1980, cassava cv. Chiroza was grown either in monoculture or in rotation with *Crotalaria juncea* (as green manure), maize, dry, beans and grain sorghum. Cropping systems such as OM and CEC were improved by rotation. Most notably, legumes increased P availability but chemical fertilizer had little detectable influence. Cassava root yields, after declining to 15 t/ha during the five consecutive farmer-grown crops, were raised in the first experimental monoculture crop through improved agronomic practices to about 25 t/ha but declined to about 10 t/ha in the fourth experimental monoculture crop. By contrast, in the rotational system, yields were increased to over 35 and 25 t/ha in the second and fourth cycle, respectively. Besides root yield, root and shape were seriously affected under continued cassava cultivation. Results show that chemical fertilizer alone may not be sufficient to maintain high cassava root yield and quality and that rotation with green manure plants, cereals and legumes may be required to activate soil life and reduce phytosanitary problems.

RESUME

Un essai de systèmes de culture du manioc a été conduit à Caicedonia, Colombie, sur un andosol dégradé ayant déjà supporté cinq cultures de manioc. A partir de 1980, le manioc c.v. Chiroza a été conduit soit en monoculture, soit en rotation avec Crotalaria juncea (comme engrais vert), maïs, haricot à grains et sorgho à grains. Les systèmes de culture ont été subdivisés en traitements fertilisés ou non. Les paramètres du sol "matière organique" et "CEC" ont été améliorés par la rotation.

L'effet le plus notable est l'augmentation de la disponibilité du P par les légumineuses, alors que celui de la fertilisation minérale est à peine détectable. Descendus à 15 t/ha au long des cinq cultures consécutives en milieu paysan, les rendements en tubercules de manioc sont remontés en monoculture expérimentale à 25 t/ha en premier cycle (avec les itinéraires techniques utilisés) pour redescendre à 19 t/ha au quatrième. Au contraire les rotations ont permis d'obtenir 35 t/ha en deuxième cycle de manioc, et encore 25 t/ha au quatrième. Au delà des rendements, la taille et la forme des tubercules ont été sérieusement affectés en monoculture continue. Les résultats montrent que la fertilisation minérale ne suffit pas à maintenir un rendement et une qualité élevés des tubercules de manioc, et que la rotation avec des engrais verts, des céréales, ou des légumineuses est impérative pour activer la vie microbienne du sol et réduire les problèmes phytosanitaires.

INTRODUCTION

There are numerous examples of successful monoculture systems in temperate zones where powerful inputs in combination with mechanization can control the agricultural environment, which by nature is stable and well buffered (v. BOGUSLAWSKI et al 1976, DEBRUCK 1972, POMMER et al 1979). However, in the less stable ecosystems of the tropics, the switch from a traditional to an input-dependent production system with its impoverishment in crop diversity has often lead to soil degradation and accumulation of phytosanitary problems posing serious hazards to yield stability (LOMBIN 1981, McINTOSH and SURYATNA EFFENDI 1979, NICKEL 1973). If the question of how to hydroxide (Kocide 101) at a rate of 770 g a.i./ha. No insecticides and fungicides were applied to the sorghum. All crops were handharvested and maize and beans were handthreshed whereas sorghum was combine-threshed.

Soil samples were taken every time a new crop was planted and analyzed at CIAT. Methods of analysis were : the Walkley-Black method for organic matter : the glass electrode potentiometer method with a 1:1 soil:water mixture for soil pH; the Bray II method for P and K ; and KCl extraction for the cations Al, Ca, Mg, and Na. Zink and Cu were determined by the HCl-H2SO4 extractant of North Carolina and B by hot water extraction. Soil and root samples for mycorrhizal analysis were also taken at the age of 1, 5 and 11 months of cassava in 1983-84.

Results

1. Cassava yields over a nine-year period

Cassava fresh root yield was only recorded with experimental precision during the four crop cycles starting in 1980. However, due to the farmer's record keeping on the