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SHORT COMMUNICATION

INFLUENCE OF SEED SIZE ON SEED AND SEEDLING CHARACTERISTICS OF *CENTROSEMA PUBESCENS*

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ABSTRACT

Seed of centro of different sizes was produced from ungraded seed under three support systems; unstaked, staked and intercropped with cassava. The effect of seed size (as a result of production system) and planting depth on germination rate, germination percentage and seedling vigour were examined during laboratory and screen house experiments. Results showed slight but nonsignificant differences in seedling performance of 100 seeds weighing 3.0 and 2.9 g (from intercropped and staked centro, respectively), while seedling performance of above seeds was significantly (P<0.05) higher than that of unstaked centro whose 100 seeds weighed 2.6 g. Positive associations between seedling performance and seed size were also observed. Production of centro seed from cassava supported or staked plants yielded larger seed size and better seedling performance compared to unstaked growth.

Key Words: **Germination, planting depth, seed dry weight, vigour**

RÉSUMÉ

La semence de centrosema de grosseurs différentes était produite, à partir des semences non triées, dans trois systèmes suivants: non tuteuré, tuteuré et en association avec le manioc. L'effet de la grosseur de la semence (dûe au système de production) et de la profondeur de semis sur les taux et pourcentage de germination et la vigueur de plantules était examiné au cours des expérimentation en laboratoire et en serres. Les résultats ont montré une petite différence non significative sur la performance de plantules provenant de 100 grains pesant 3,9 et 2,9 gr. (de centrosema en association et tuteuré, respectivement), tandis la performance de ces plantules était significativement (P<0.05) plus élevée que celles provenant de centrosema non tuteuré dont 100 grains pesait 2,6 gr. Des associations positives étaient observées entre la performance de plantules et la grosseur de semences. La semence de centrosema produite sur des plants associés au manioc ou tuteuré a donné des grains plus gros et des plantules plus performantes par rapport au centrosema non tuteuré.

Mots Clés: **Germination, profondeur de plantation, poids sec de plantules, vigueur**

INTRODUCTION

Centrosema pubescens (centro) is a climbing forage legume whose seed yield has been improved by provision of support systems (Ferguson, 1978; Humphreys and Riveros, 1986). Improved seed yield has been associated with an increase in 100-seed weights (Akinola and Agishi, 1989; Lusembo *et al.*, 1993). However, there is a dearth of information on how support systems affect the quality of seed of centro when they increase seed size. Seed germinating percentage under laboratory conditions is the standard measure of seed quality (ISTA, 1976). However, seed lots with the same germination percentage may germinate at different rates (Duorado, 1989). Therefore, seed vigour is becoming an increasingly important measure of seed quality especially in forage legumes (Chin and Wong, 1993). Because seedling vigour is difficult to measure quantitatively, germination and seedling growth rates have been used as reference indices for vigour tests (Halmer and Bewley, 1984; Wang and Hampton, 1993). Seedling vigour is important in crop establishment under stressful conditions like low moisture and high planting depths (Dalianis, 1980). Fast germination of seeds ensures early seedling establishment before the depletion of seed reserves and would also avoid subsequent adverse conditions like moisture stress and competition with fast growing weeds.

Seedling vigour is related to seed size in *Lotus corniculatus* (Hanson and Tayman, 1961; Stickler and Wasson, 1963), *Glycine max* (L.) Merrill (Burris *et al.*, 1973; Smith and Camper, 1975; Reddy *et al.*, 1989), and *Trifolium resupinatum* and *T. alexandrinum* (Dalianis, 1980). Therefore, agronomic practices that influence the weight of individual seeds may similarly improve the overall quality of the seed. Experiments reported here were aimed at establishing the influence of seed size (as result of production system) on seedling vigour of centro.

MATERIALS AND METHODS

Seeds of centro produced by growing the legume in small plots under three support systems, namely unstaked, staked and intercropped with cassava weighed 3.0, 2.9 and 2.6 g for 100 seeds, respectively (Table 1). Seeds were scarified with concentrated (1 M) sulphuric acid and washed with tap water before planting to facilitate germination.

Laboratory germination. Four replications of 100 seeds from each production system (3.0, 2.9 and 2.6 g) were placed in petri-dishes on four layers of tissue paper moistened with tap water (5 ml) on alternate days, and left to germinate. Germinated (plumule emergence) seedlings were counted and removed every day from the third to the ninth day. The rate of germination was calculated by;

$$\text{Rate of germination} = X_1/Y_1 + (X_2-X_1)/Y_2 + ...(X_n-X_n-1)/Y_n$$

Where, X_n = percentage seedling emergency at n^{th} count and

Y_n = number of counts from planting to n^{th} count (Maguire, 1962). The experimental design was a completely randomised block.

Simulation of field germination in a screenhouse. The study was arranged in a completely randomised block design with four replications. Polyethylene pots measuring 6 x 6 cm were filled to a depth of 15 cm with sandy loam soil collected from the top-most 10 cm at Namulonge. Three seeds were planted at a soil depth of 2 cm in each of five pots for each subplot. The pots were placed in a screenhouse where they were watered to field capacity on alternate days. One seedling was selected at random from each pot for record observations. This resulted in five seedlings sampled for each subplot. From the third to the ninth day after planting the number of seedlings whose plumule appeared above the soil surface was counted as germinated and removed each day.

Determination of seedling dry weight increase. Planting was done as in the second experiment. Seedlings were cut at the cotyledon attachment points at 10, 17, 24 and 31 days after planting. The parts above the point of cutting constituted the shoot while those below were the root system. A gentle stream of tap water was directed on to the soil surface to wash the root parts clean of the soil.

Dry weight of the roots (no cotyledons) and shoots of the seedlings was determined after drying fresh material of 5 seedlings in an oven (60° C) for 48 hr. The study was arranged in a completely randomised block design in split plots, with seed size as the main plots while subplots were sampling dates.

Effect of planting depth on seedling dry weight. Pots similar to those used in the last two experiments were used in this study. Planting was done at soil depths of 1, 2, 3 and 4 cm and sampling done at 14 days after planting. The study was arranged in a completely randomised block design in split plots, with seed size as the main plots while planting depths were the subplots. The same procedure as in the third experiment was used to determine dry matter of the seedlings. Data were subjected to analysis of variance using the MSTATC statistical software package.

RESULTS

There was a positive correlation between the mean weight of 100 seeds and the rate of germination (R^2=0.89). The germination percentage also followed a similar trend up to the ninth day after planting. The rate and percentage of seedling emergence from seeds of different sizes (as result of support systems) when planted at a soil depth of 2 cm were not significantly different although seeds with higher mean weight obtained from the intercrop tended to have higher values (Fig. 1). There was a significant difference (P<0.001) between seeds with different sizes in terms of rate and percentage germination, while total percentage germination at the end of the trial was similar for seeds with 2.9 and 3.0 g for 100 seeds but significantly (P<0.001) higher than that of 2.6 g for 100 seeds obtained from the unstaked crop (Table 1.). There was no significant difference in root dry weight of 100 seeds weighing 2.9 and 3.0 g when seed was planted at various soil depths and sampled at 14 days after planting, although there was a general tendency for the weight to decrease with increasing planting depths (Fig. 2A).

There was no interaction between seed sizes and planting depth on root dry weight. However, shoot dry weight of 100 seeds weighing 2.9 and 3.0 g was similar but significantly (P<0.05) higher than that of 2.6 g from the ustaked crop (Fig. 2B). The effect of seed size of centro on root dry weight of seedlings sampled at 10, 17, 24 and 31 days after planting is shown in Fig. 3A. Seedling roots from larger seeds (2.9 and 3.0 g for 100 seeds) of the support systems had the same weight which in turn was significantly (P<0.05) greater than that of the smallest seeds (2.6 g for 100 seeds) from the unstaked crop. Dry weight of the shoots of seedlings obtained from the small seeds of the unstaked crop, increased faster than those of the larger seeds and almost had similar weights by the

TABLE 1. Effect of support system on seed weight, germination rate and percent germination of *Centrosema pubescens*

	Production system			
	Cassava-centro intercrop	Staked	Unstaked	SEM
100-mean seed weight (g)	3.0a	2.9a	2.6b	±0.1
Germination Percentage*	97.0a	85.0b	79.0c	±2.1
Germination rate*	30.0a	24.0b	21.0c	±0.9

Means in the same row with different letters are significantly different (P<0.05).
* Germination percentage and rate (number per day) were positively correlated (R=0.89) with seed size (data not shown)
SEM= Standard error of means

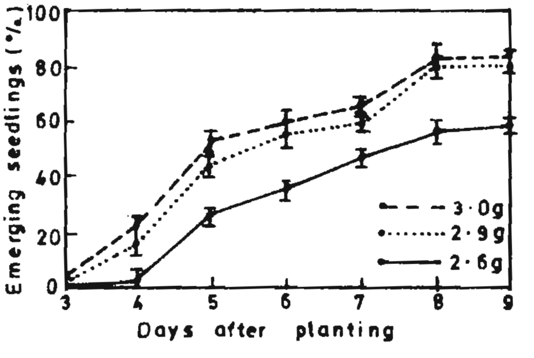

Figure 1. Effect of 100-seed weight of centro on the percentage seedling emergence when planted at 2-cm depth. Vertical bars are standard errors of means.

end of the experiment (Fig. 3B). Total dry weight of seedlings (Fig. 3C) followed a similar trend to shoot dry weight (Fig.3B).

DISCUSSION

Despite teh lack of significant difference between the weights of 100 seeds of the intercrop and staked crops, the germination rate and germination percentage were significantly ($P<0.05$) different. This implied that a slight increase in seed size may greatly improve the rate and germination percentage. Seed size, as result of production system, had a significant influence on seedling vigour. This was shown by the number of seeds that germinated and emerging in the laboratory and in the screen house, respectively. This was further supported by the amount of dry weight of the seedlings of various planting depths and different ages of sampling. However, there could be weight ranges within which seedling vigour remains the same although a slight increase in the weight of 100 seeds of the intercrop over the staked crop significantly increased the rate and percentage of laboratory germination. This is because most of the seedling characteristics of 2.9 and 3.0 g, from the two support systems, were statistically similar despite the slight differences in the weight of 100 seeds. It is possible that there is a critical or minimum weight below which seedling development may become constrained. It appeared, however, that the importance of seed

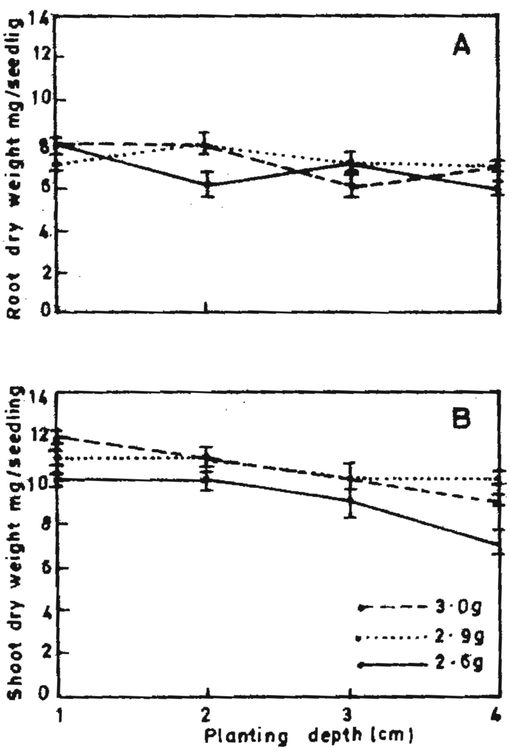

Figure 2. Effect of 100-seed weight (g) of centro on A) root dry weight and B) shoot dry weight of 14-day old seedlings planted at varying depths. Vertical bars are standard errors of means

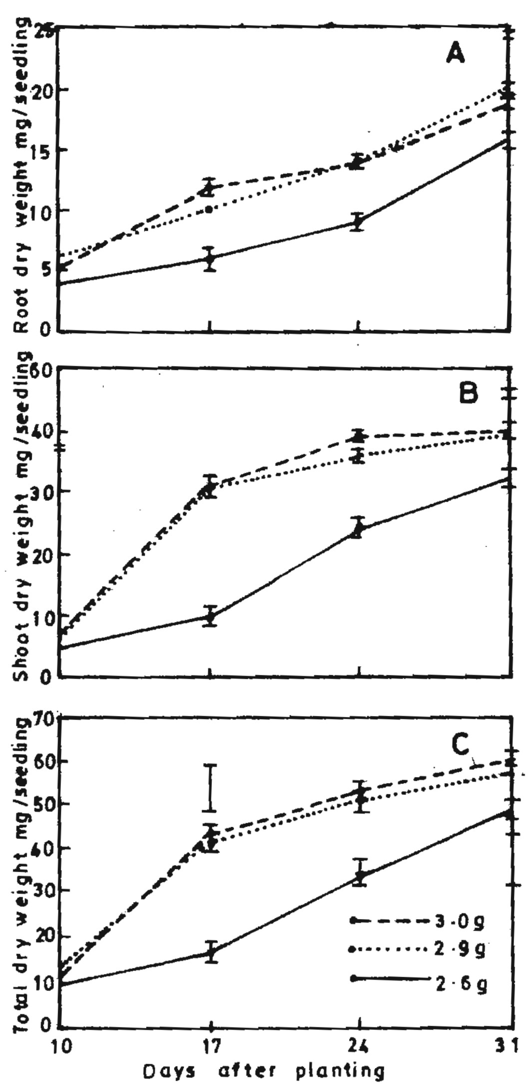

Figure 3. Effect of 100-seed weight (g) of centro on A) root dry weight, B) shoot dry weight, and C) total seedling dry weight at 10, 17, 24 and 31 days after planting at 2-cm depth. Vertical bars are standard errors of means.

size declined as the seedlings developed into plants. This was shown by the fact that seedling dry matter weight after 24 and 31 days of planting were similar irrespective of production systems (Fig. 3C). This suggests that if a seedling survived early in development, it could develop into a normal plant. In centro, the importance of seed size may be limited to seedling development only. This implies that conditions that allow the seeds to germinate and develop would eliminate the need to have a particular production system for the quality of seed. Under ideal conditions of germination, however, seed size has a profound effect on field performance of centro, as determined by seedling performance and germination rate.

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