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Variability in productivity of *Mucuna pruriens* varieties in a semi-arid environment

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Abstract — In North Cameroon, several varieties of *Mucuna pruriens* are being propagated both by research institutes and elsewhere by development agencies as cover crops for mulch or forage. These varieties may vary in productivity and performance as a result of climatic and edaphic factors. Six varieties were planted in a completely randomised design with four replications and their performance evaluated in terms of ground cover, biomass, age at maturity and seed yield. The best ground cover was obtained with *Mucuna pruriens* ecotype Mayo Boki at 30 DAP (Days after planting) while the least was obtained with *Mucuna pruriens var nagaland* and *var veracruz*. Herbage yield was highest with *M. pruriens ecotype Ghana* (5.5 tons/ha) and lowest in *M. pruriens var nagaland*(1.3 tons/ha). Four varieties, *M. pruriens ecotype Far North, M. pruriens ecotype Ghana, Mucuna pruriens ecotype Mayo Boki* and *M. pruriens var nagaland* matured between 88 and 101 DAP, while the remaining two, *M. pruriens var veracruz blanc* and *M. pruriens var preta* matured later at 112 DAP. Seed yield was highest in*, M. pruriens ecotype Mayo Boki* (5.1 tons/ha) and least in *M. pruriens var preta* (0.4 tons/ha). There was a highly significant difference in seed weight (P<0.0001), with *M. pruriens Mayo Boki* being highest and *M. pruriens var preta* being the lowest. Total seed production by weight was generally higher in large seeded varieties, which were also the early maturing varieties. This collection could thus be regrouped into early and late maturing varieties. The early maturing varieties produced more seeds, which were larger, while the late maturing varieties produced less and smaller seeds. Depending on the farmer's objectives, both short or long cycle varieties could be of use in this region. Other parameters such as palatability and nutrient value have to be tested if they are to be recommended for livestock feeding.

Résumé — **Productivité des différentes variétés de *Mucuna pruriens* en zone semi-aride.** Plusieurs variétés de *Mucuna pruriens* ont été diffusées au Nord-Cameroun par les instituts de recherche et les organismes de développement comme plantes de couvertures ou fourragères. Ces plantes sont variables tant du point de vue de la productivité que de leurs performances en fonction des conditions climatiques et de facteurs édaphiques. Six variétés ont été semées selon un dispositif entièrement randomisé avec quatre répétitions et leurs performances évaluées en termes de couverture du sol, de la biomasse, de l'âge à la maturation des graines, et de leur production de semences par l'analyse de variance. Le meilleur recouvrement du sol est obtenu avec *Mucuna pruriens* var nagaland et var veracruz. La plus grande production de biomasse végétative est obtenue avec *Mucuna pruriens* écotype Ghana *(*5,5 t/ha) et la plus faible avec *Mucuna pruriens* var nagaland (1,3 tha). Quatre variétés *M. pruriens* écotype Far North*, M. pruriens* écotype Ghana*, Mucuna pruriens* écotype Mayo Boki et *M. pruriens* var nagaland bouclent leur cycles biologique en 100 jours. Elles peuvent être considérées comme précoces. Les autres, à cycles intermédiaires ou longs (*M.* pruriens var veracruz blanc et *M. pruriens* var preta*),* bouclent leur cycle biologique en 112 jours. Une différence hautement significative a été observée sur la production de semences. La plus grande production est obtenue avec *M. pruriens* écotype Mayo Boki (5,1 t/ha), et la plus faible avec *M. pruriens* var preta (0,4 t/ha). La production de semences à été plus importante avec les variétés à grosses graines qui sont également les plus précoces. En fonction des objectifs des agriculteurs, les variétés à cycles courts ou celles à cycles longs peuvent être utilisées dans la région. D'autres paramètres telles que l'appétibilité, et la valeur nutritive doivent être testés si certaines variétés doivent être recommandées pour l'élevage.

Introduction

Forage legume species vary in performance and productivity according to regions. Due to lack of an organised seed production system, farmers continue to get seeds from where ever they can with the risk of crop failure from poor adaptability. Adaptability is often influenced by the climate, soil characteristics or the farming system in practice in the different regions. Legume cover crops are seen as an appropriate component in the farming system of North Cameroon where it would provide both live and dead vegetative cover to protect the soil from erosion and runoff, build up the soil nutrient status and provide high protein feed for livestock. In this system where much interest is seen in the need for a good soil cover, as well as need for good quality forage for livestock, a lot can be obtained from high forage producing legumes.

Several legume species have been tested and found adapted to this region. Constraints to adoption by farmers include cost of establishment, protection from free-grazing herds and lack of seeds. Several techniques for establishment such as incorporating in the farming system have been introduced as a means of reducing establishment costs. Farmers however look forward for species that would offer a range of advantages, such as, soil cover and improvement, high herbage yield, as well as being fit for both human and livestock consumption.

Mucuna pruriens is a creeping legume, which is attractive in this region for its soil covering capacity. This legume offers good mulch and soil cover and farmers are getting more and more interested in its nutritive capacities. Locally, it is being used for tea as well as mulch in cereal mixtures in the North and Far North provinces of Cameroon. The origins of the existing varieties are however doubtful as farmers no longer remember where the seeds were obtained. Their productivity and performance can therefore not be justified. Several other *Mucuna* varieties are being used in other countries in the region for purposes ranging from weed control, soil cover and both animal and human consumption. These varieties have different characteristics that differentiate them from each other even though not often identifiable from the seeds.

Variability within a plant species may be morphological or in productivity and may also differ from one place to another. This trial was therefore meant to test the performance of these local *Mucuna varieties* with those obtained from The Centre for Cover Crops Information and Seed Exchange in Africa (CIEPCA), Benin Republic and to multiply seeds for further evaluations and eventual dissemination to farmers.

Materials and methods

This trial was carried out on-station at the Institute for Agricultural Research for Development (IRAD), Garoua located in the sudano-sahelian zone of North Cameroon. Rainfall for the year of study (2000) averaged 960mm in the area and the soil at the experimental site is sandy loam.

Experimental layout

Six *Mucuna pruriens* varieties (Table I) were planted into 55m2 plots in a randomised design with four replications. They were planted at recommended densities of 20-30kg/ha. Triple super phosphate was applied at the rate of 15kg/ha by broadcast, three weeks after planting. All plots were weeded twice between 30 and 60days after planting.

Parameters measured

The general performance of the legumes after germination (i.e. germination, flowering, and seeding), were observed and recorded at every stage. Spread/ ground cover was determined at 30 and 60 days after planting (DAP) using a line-point transect method (Daugherty *et al*, 1990), where a tape was stretched diagonally across the plot and the proportion of points in line with vegetation recorded at 5 cm intervals. Herbage was sampled twice, at 90 and 120 days after planting from 1m2 plots. Forage samples were collected and dried in the oven at 60 degrees Celsius for 48hours. At maturity, seed from entire plots were harvested and weighed. Five samples of 100seeds per species were counted and weighed to obtain the 100 seed weights.

Statistical analysis : Statistical differences between means were determined by ANOVA using SAS.

Table I. Origin of *Mucuna pruriens* varieties.

Plant Species	Origin
Mucuna prurens ecotype Far North	Far North Province, Cameroon
Mucuna prurens ecotype Mayo Boki	North Province, Cameroon
Mucuna prurens ecotype Ghana	CIEPCA, Benin Republic
Mucuna prurens var Nagaland	CIEPCA, Benin Republic
Mucuna prurens var preta	CIEPCA, Benin Republic
Mucuna prurens var veracruz blanc	CIEPCA, Benin Republic

Results

Establishment

Four *Mucuna* varieties flowered three weeks earlier (table II). This group could be considered as early varieties as they flowered between 45 and 65 DAP.

Table II. Performance of selected *Mucuna pruriens* varieties.

SPECIES	Onset of flowering (DAP)	Onset of seeding (DAP)	Onset of maturation (DAP)	Herbage yield (TDM/ha)
Mucuna pruriens ecotype Far North	58*	74	88	1.8
Mucuna *pruriens* var Ghana	62*	88	101	5.5
Mucuna pruriens ecotype Mayo Boki	56*	83	97	1.6
Mucuna pruriens var nagaland	64*	71	89	1.3
Mucuna pruriens var preta	92	103	112	2.5
Mucuna pruriens var veracruz blanc	91	101	112	1.6

* Early maturing varieties.
DAP = Days after planting.

Ground cover and herbage yield

All the *Mucuna pruriens* varieties gave an impressive ground cover. However, there were slight differences amongst them (Table III). Early spread and cover was obtained with *Mucuna pruriens* ecotype Mayo Boki, a local variety at 30 DAP. This possibly indicates its adaptability in the region. *M. pruriens ecotype* Far North and *M. pruriens* ecotype Ghana on their part gave the best cover at 60 DAP (figure I).

Herbage yield

Herbage yield was highest in *M. pruriens* ecotype Ghana. and lowest in *M. pruriens* var nagaland (table II). The lowest amongst the *Mucuna* varieties was however still higher than yield from the other species that are being used in this region.

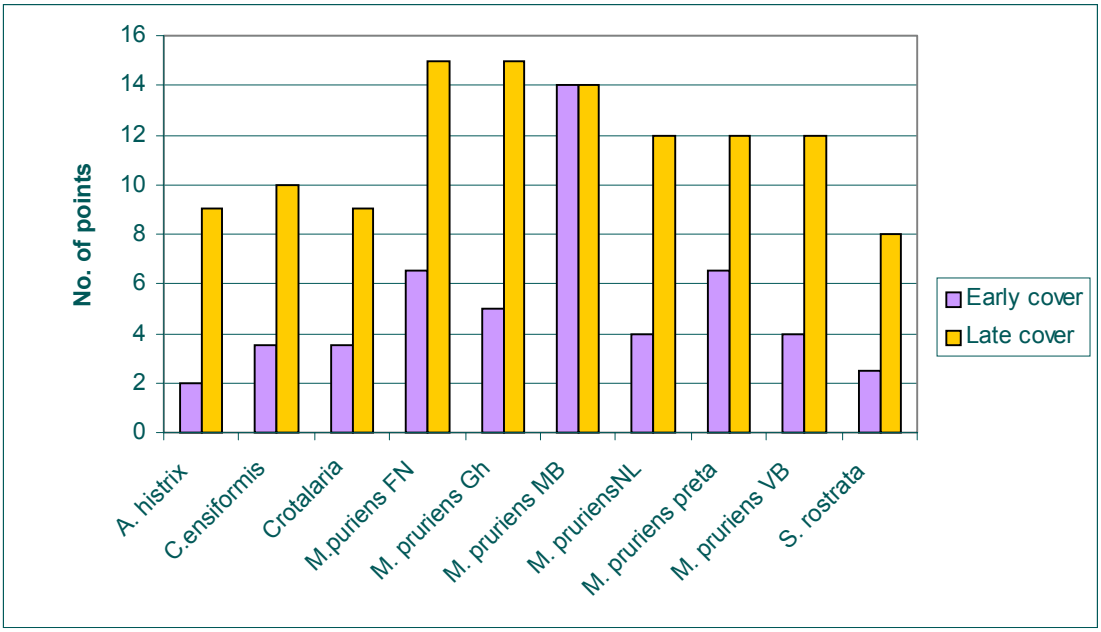

Figure 1. Spread/cover of introduced forage legume species.

Table III. Germination and ground cover of *Mucuna pruriens* varieties.

Species	Germination rate 20 DAP (%)	Early Cover 30 DAP(points)	Late Cover 60 DAP(points)
Mucuna pruriens ecotype Far North	90	6.5	15
Mucuna species var Ghana	100	5	15
Mucuna pruriens ecotype Mayo Boki	100	14	14
Mucuna species var nagaland	60	4	12
Mucuna species var preta	80	6.5	12
Mucuna species var veracruz blanc	80	4	12

Seed yield/Productivity

Seed yield in *M. pruriens* varieties ranged from 0.4 tons/ha in *M. pruriens* var preta, to 5 tons/ha ecotype Far North (Table IV). Seeds of the different varieties differed in size, shape (slightly) and colour. There were small-seeded and large seeded varieties. Colours ranged from dirty white in *M. pruriens* var veracruz *blanc*, to different shades of brownish /black spots in *M. pruriens* ecotype Mayo Boki, *M. pruriens* ecotype Ghana, *M. pruriens* ecotype Far North, *M. pruriens* var nagaland and pure black in *M.pruriens var preta*. There was a close resemblance in seed structure and colour between *M. pruriens* ecotype Mayo Boki, *M. pruriens* ecotype Ghana, *M. pruriens* var nagaland *and M. pruriens* ecotype Far *North*. Their 100 seed weight was also higher than those of the late maturers. These four varieties also turned out to be the four early maturing varieties. This could be an indication of some closer genetic linkage or common origin.

Table IV. Seed yield and productivity potential for *Mucuna pruriens* varieties.

Species	Yield (t/ha)	100 Seed weight (g)
Mucuna pruriens ecotype Far North	3.381	82.3± 1.2
Mucuna species var Ghana	2.672	83.3 ± 3.1
Mucuna pruriens ecotype Mayo Boki	5.109	92.3 ± 1.8
Mucuna species var nagaland	3.090	90.3 ± 2.2
Mucuna species var preta	0.4	57.3 ± 1.8
Mucuna species var veracruz blanc	1.163	60.1 ± 2.5

Discussion

In this study, variability in *Mucuna pruriens* varieties was noted at all levels of the plant cycle (establishment, herbage and seed yield, seed size and colour). This permitted their regrouping into long and short cycle varieties, with the short cycle varieties (*M. pruriens* ecotype Far North, *M. pruriens* var Ghana, *M. pruriens* ecotype Mayo Boki and *M. pruriens* var nagaland) being more productive, in terms of herbage (*M. pruriens* var Ghana) and seed yield (*M. pruriens* ecotype Mayo Boki). There is some relationship between productivity and size of seeds (figure 2). Large seeded varieties produced more and are the short cycle varieties. This can therefore provide an initial identification factor to the farmer.

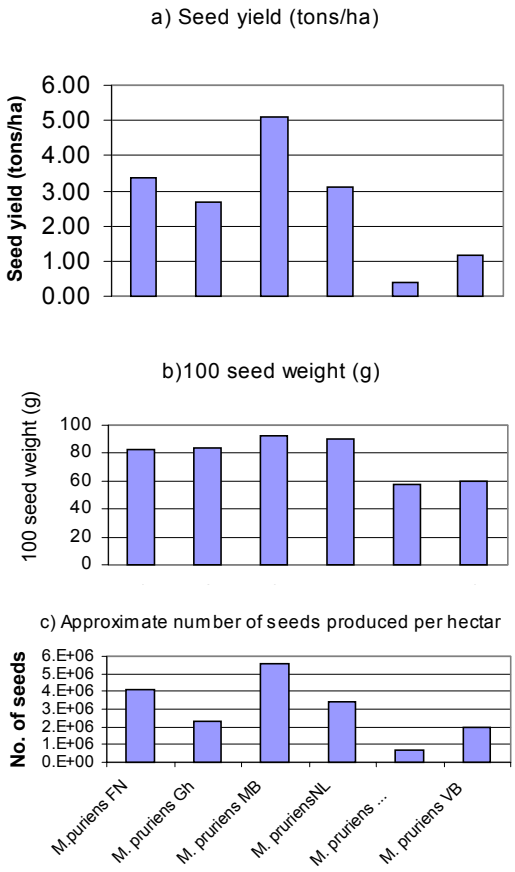

Figure 2. Seed production potentials of introduced varieties of *Mucuna pruriens*.

In this region where climate plays a major role in the persistence of plant species, the rate of establishment and plant cycle is primordial in selecting for adaptability. This short cycle characteristic makes this group suitable for areas with short growing periods such as is found in the semi-arid region of Cameroon, where the cropping season runs from June-September and in most instances with surprise draught periods in the middle of the growing season.

The covering capacity of legumes is also an important and desirable characteristic for legumes in this region where soils are prone to exposure and weed infestation due to overexploitation. Species with good ground cover would offer an efficient mulch, weed and erosion control. *M. pruriens* is being successfully used for the control of the noxious weed, *Imperata cylindrica* in Benin, a characteristic that ranked highest among farmers as one of the reasons for growing the species (Houndékon *et al*, 1998).

Its high herbage yield is an indication of good mulch for soils and possibly forage for livestock, depending on its palatability. They could therefore provide good forage for livestock in this system where livestock nutrition and feeding is a major concern. Results from Ghana have shown some success in its

use for feeding pigs as well as for human consumption in soups (Osei-Bonsu, 1998). In this region, not much has been recorded on its use in human or livestock feeding, even though it has been widely grown in cereal-legume associations, and is often harvested with cereal residues for livestock feeding.

Conclusion

These results indicate some promising potentials of these legumes. Their clear demarcation into short and long cycle varieties provides the farmer with a range to choose from depending on what his primary objectives would be. Studies with *Mucuna pruriens* in other countries of the region have been very promising in terms of usefulness. These are avenues to be looked into in further evaluations especially where livestock and weeds play a major role in the agricultural productivity. Short cycle varieties would be useful in soil improvement, where they are planted early and turned in the soil as mulch before the main crop. Long cycle varieties on the other hand would mature late in the season, thus provide forage and soil cover against evaporation when this resource is highly needed. Its contribution in livestock nutrition should be clearly evaluated for its effective utilisation in this domain. There is also need to develop seed production systems that would provide a desired variety at a given time to the farmer in need. Research and development organisations should therefore see to it that the farmer uses the variety that will meet his or her expectations for an effective utilisation of this species.

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