PERFORMANCE OF DIFFERENT MUNGBEAN VARIETIES GROWN IN THE OPEN FIELD

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ABSTRACT

Sixteen varieties of mungbean grown in ViSCA during the wet season were evaluated for their growth and yield performance in the open field. Their agronomic parameters measured such as seedling emergence, flowering, maturity, plant height, and number of nodules developed per plant differed significantly among varieties. Most of the varieties showed marked differences in their yield and yield components. The highest dry bean yields were obtained from CES ID-21 (916.4 kg/ha) and CES N30 (867.3 kg/ha). Varieties which developed more nodules generally produced higher grain yields than those which developed less nodules. Three mungo varieties (CES 87, EGMY 377-21, and EGMY 161-1) were found to be low grain yielders. However, they produced the heaviest fresh herbage yield which is important for forage as well as for green manure.

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INTRODUCTION

Mungbean *(Vigna radiata* (L.) Wilzeck) is cultivated in the Philippines mostly for its seeds and there are farmers who raise this crop because they realize its commercial potential. However, they find difficulty in securing the variety best suited to local conditions. This study presents the agronomic characteristics and yield performance of 16 mungo varieties planted in the open field under ViSCA conditions.

MATERIALS AND METHODS

An area of 864 sq m was prepared and planted to 16 mungbean varieties, namely: CES 2C-1, CES ID-21, CES IF5, CES IG3, CES N30, CES 87, EGMY 17, EGMY 161-1, EGMY 377-21, EGMY 174-3, MD15-2, MG-50-10A-G, MG50-10A-Y, V-2184, M350, and V-2773. A randomized complete block design was used. The whole area was divided into four replications. Each block was divided into 16 treatments, representing the number of mungo varieties studied, with each treatment having four 6-m rows spaced at 50 cm between rows. Individual treatment was assigned at random.

Complete fertilizer (14-14-14) was applied before planting at the rate of 45 kg/ha each of nitrogen (N), phosphorus (P) and potassium (K), which was equivalent to 96.4 g of the material per row. Clean seeds of the 16 mungo varieties were drilled in the rows. Within five days after emergence, the plants were thinned to 15 plants per linear meter to get the desired plant density of 300,000 plants/ha.

RESULTS AND DISCUSSION

In general, the mungbean varieties tested showed significant differences in their growth habit and yield performance under ViSCA conditions during the wet season. This could be attributed partially to their varietal characteristics which responded differently under local conditions.

Agronomic Characteristics

Days to Emergence.

The emergence period of the 16 mungbean varieties ranged from 4.2 to 6.5 days (Table 1). Among the 16 varieties evaluated, MG50-10A-G and EGMY 161-1 were the earliest to emerge, while MG50-10A-Y and CES N30 were the latest.

The variations noted on these different varieties may be due to temporary dormancy of some seeds. Permeability of the seed coat or pericarp could also be another factor since water entry into the seeds is greatly influenced by the nature of the seed coat. It is also possible that the germination of other seeds was retarded by excess moisture because of long, heavy rains which occurred after sowing. Another possible reason was the non-uniformity of seed distribution and placement. Some seeds might have been sown deeper that these took time to emerge above the ground surface.

Days to Flowering.

The number of days from planting to flowering ranged from 36.2 to 39.8 days (Table 1). Varieties MG50-10A-G and MG50-10A-Y were the earliest to bear flowers, while CES ID-21 and EGMY 377-21 were the latest.

Although some of the varieties germinated at about the same time, their flowering dates were significantly different. Differences might be attributed to their varietal characteristics and varying responses to local conditions.

Days to Maturity.

The maturity period of the 16 mungbean varieties ranged from 59.2 days (MG50-10A-G and EGMY 377-21) to 62 days (MG50-10A-Y and CES ID-21) from sowing (Table 1).

Although EGMY 377-21 was the latest to flower among the varieties,

Table 1. Agronomic characteristics of 16 mungbean varieties grown in the open field.[1]

Variety	Number of days from sowing to			No. of nodules/plant	Plant height at maturity (cm)	Weight of fresh herbage (t/ha
	Germination	Flowering	Maturity			
CES 2C-1	5.5 abcd	37.7 abcd	60.5 bcda	42 abcdefg	95.1 abc	14.1 cdefg
CES 87	5.2 abcd	37.7 abcd	60.2 cde	27 efg	90.8 bcdef	18.1 a
CES N30	4.5 cd	37.0 bcd	59.5 de	50.7 a	95.7 ab	12.3 hijk
CES IF5	5.8 abc	38.7 abcd	60.7 abcd	30.0 defg	91.7 abcde	15.3 bcde
CES ID-21	6.5 a	39.7 a	62.0 a	50.5 ab	84.0 fghi	13.7 cdefghi
CES IG3	5.0 bcd	37.5 bcd	60.2 cde	44.2 abc	81.3 i	11.6 k
EGMY 17	4.8 bcd	37.7 abcd	59.7 de	27.2 efg	83.6 ghi	13.7 defgh
EGMY 377-21	6.5 a	39.7 a	59.2 c	26.2 g	92.5 abcd	16.7 ab
EGMY 174-3	5.0 bcd	37.2 bcd	59.2 de	38.0 abcdefg	87.8 cdefghi	15.5 bcd
EGMY 161-1	4.2 d	36.7 cd	59.5 de	27.7 defg	90.2 bcdefg	15.5 bc
M350	5.2 abcd	37.7 cd	60.7 abcd	40.2 abcdefg	90.1 bcdefgh	13.6 cdefghij
MG50-10A(G)	4.2 d	36.2 d	59.2 e	42.7 abcde	83.9 fghi	10.8 k
MG50-10A(Y)	4.5 cd	36.2 d	61.7 ab	43.5 abcd	82.7 i	11.1 k
MD-15-2	5.0 bcd	38.0 abcd	60.0 cde	39.0 abcdefg	98.4 a	13.7 cdefgh
V-2184	4.8 bcd	36.7 abc	59.5 de	42.5 abcdef	86.5 defghi	10.8 k
V-2773	6.0 ab	39.0 ab	61.2 abc	42.5 abcdef	86.3 defghi	15.0 bcdef
C.V.	15%	3%	1%	24.76%	4.8%	8%

[1] Means followed by a common letter are not significantly different at 5% level (DMRT).

it matured earlier than most of them. MG50-10A-Y, which was the earliest to flower, matured the latest. these variations may be due to the inherent agronomic characteristics of the varieties. Some are early-maturing while others are late-maturing. It could also be attributed as well to the effect of light and temperature. There are varieties which favor higher light intensity and temperature during the cropping period while there are others which do not.

Number of Nodules Per Plant.

Nodule development plays an important role in legume production because it indicates the presence of rhizobia which are capable of fixing atmospheric nitrogen, rendering it available for plant use. It was assumed that the more nodules formed per plant, the higher the amount of N fixed.

The average number of nodules per plant ranged from 26.2 to 50.8 (Table 1). Varieties CES N30 and CES ID-21 developed the highest number of nodules per plant with averages of 50.8 and 50.5, respectively. CES 87 and EGMY 377-21 had the poorest nodule production, with 27 and 26.2 nodules per plant, respectively.

As expected, the production of nodules influenced pod formation and eventually influenced grain yield production. Varieties which produced more nodules (CES ID-21, CES N30, V-2773, and V-2184) also produced more pods, which ultimately led to higher grain yield.

The above-mentioned high-yielding varieties also produced the greatest number of nodules per plant, as opposed to the low-yielding varieties. Poor nodule formation, as manifested by very few and pale-colored nodules, suggested that the microorganisms in the root were fewer and therefore were less effective in fixing nitrogen from the atmosphere and synthesizing it into simpler form for immediate plant use. This condition contributed to yield decrease of the crop.

Plant Height at Maturity (cm).

Table 1 shows the average plant height of the 16 mungbean varieties at harvest. The tallest among the varieties was MD15-2 (98.4 cm), while the shortest was CES 1G3 (81.3 cm).

Variations in height among the plants can be attributed to their inherent characteristics and to the effects of environmental conditions like low temperature during the experiment. When the temperature dropped to a level not favorable for plant growth, the plants probably became quiescent, even though respiration and photosynthesis slowly continued, thereby affecting growth.

Fresh Herbage Yield (t/ha).

The average weight of fresh herbage at harvest ranged from 10.8 t/ha (MG50-10A-G) to 18.1 t/ha (ES 87). Aside from being tallest, varieties with higher fresh herbage yields produced more lateral branches. As expected, varieties with higher fresh herbage yield also had rapid growth and developed more lateral branches.

Production of more herbage is important since it may affect the grain yield of the crop. As noted, varieties with heavy fresh herbage had the least grain yields. This might be attributed to the translocation and utilization of most of the plant food for luxuriant vegetative growth of the plants at the expense of grain yield.

Production of more fresh herbage, however, is not at all disadvantageous, since such varieties may be used not only for forage but also as green manure.

Those varieties which formed more lateral branches and produced heavy fresh herbage were low yielders, probably because of overshading. The lower leaves perhaps became parasitic and used up the photosynthetic assimilates which were intended for grain yield. Furthermore, excessive vegetative growth of some varieties (CES 87, EGMY 377-21, and EGMY 161-10) might have caused intraplant competition, that is, the plants competed with each other for nutrients and light. In the development of their vegetative parts, plants need nutrients, light, and carbohydrate reserves for their rapid growth. However, their growth may be promoted at the expense of flower formation; competition between the vegetative parts and the reproductive organs of the plant may occur. If pods have already been developed, the competition may result in the formation of smaller and fewer pods.

Yield and Yield Components

Number of Pods Per Plant.

The first three varieties which

produced the most number of pods per plant were V-2773 (11.8), CES ID-21 (10.5), and CES IF5 (10.2) (Table 2). On the other hand, those which developed the least were EGMY 161-1 (6.5), EGMY 17 (6.5) EGMY 377-21 (7), and MD15-2 (7).

It was observed that varieties which developed more nodules also produced more pods. Conversely, those which formed less nodules also developed fewer pods.

Since the experiment was marked by long, heavy rains, climatic factors aside from varietal characteristics, might have contributed to variations.

Length of Pods Per Plant (cm).

Table 2 gives data on length of pods among the varieties. The average length of pods ranged from 7.9 cm (V-2773) to 11.63 cm (MG50-10A-G and MD15-2).

In some varieties like CES ID-21, it was noted that as more pods developed per plant, the shorter these pods became. In others like MG50-10A-G, fewer but longer pods were produced. Other than genetic variability, this can also be traced to the distribution of food reserves in the plants. If there were abundant food reserves within the plant which developed few pods, their utilization was probably geared toward increasing pod size.

Number of Seeds Per Pod.

Among the 16 varieties, CES 1G3 and MD15-2 produced the highest number of seeds per pod with averages of 14.2 and 14.0 seeds per pod, respectively. MG50-10A-Y developed the least number (10.8) of seeds per pod (Table 2).

MD15-2 produced the longest pod with the highest number of seeds per pod. However, this did not hold true with other varieties. Some varieties might have developed long pods but with few seeds in them, which were spaced far from each other.

Because some of the varieties produced more leaves, there was poor light penetration/transmission in the leaves which affected the amount of photosynthates manufactured by the plant. It may also be attributed to the capability of the sink (pods) to accumulate the net photosynthetic assimilates. Because some varieties (MG50-10A-Y and EGMY 174-3) were susceptible to diseases, defoliation occurred. When defoliation occurred during the early pod-filling stage, the ability of the plants to manufacture food was lessened, thus affecting the development of seeds.

Weight of 1,000 Seeds (g).

The average weight of 1,000 seeds of the 16 varieties ranged from 41.8 to 57 g (Table 2). V-2184, MG50-10A-G, MG50-10A-Y, and CES IG3 produced the heaviest seeds, while M350, EGMY 377-21, and V-2773 produced the lightest.

Production of heavy seeds is considered significant since it greatly contributes to high yield. When a variety produces fewer pods, this is compensated by pro-

Table 2. Yield and yield components 16 mungbean varieties grown in the open field (wet season). [1]

Variety	No. of pods/plant	Length of pods (cm)	No. of seeds/pod	Weight of 1000 seeds (gm)	Dry bean yield (kg/ha)
CES 2C-1	9.5 bcde	10.3 abcdef	13.7 abc	54.1 abcdefg	763.4 bcdefg
CES 87	8.5 efgh	9.5 cdefghijkl	11.5 efg	51.6 fghijk	433.4 m
CES N30	9.5 bcde	10.3 abcdefg	11.5 efg	50.1 ijkl	867.3 ab
CES IF5	110.9 abc	10.9 ABC	12.7 cd	49.5 jklm	578.9 kl
CES ID-21	10.5 b	8.6 kl	12.5 de	53.3 defghi	916.4 a
CES IG3	8.0 fghi	9.9 cdefghi	14.2 a	56.0 abcd	777.4 bcde
EGMY 17	6.5 i	10.6 abcd	11.5 efg	54.3 abcdef	513.6 lm
EGMY 377-21	7.0 hi	9.8 cdhij	11.5 efg	42.5 n	458.0 m
EGMY 174-3	8.0 fghi	9.9 cdefgh	11.5 efg	52.7 fghij	700.4 cdefghi
EGMY 161-1	6.5 i	9.7 cdefghijkl	11.7 defg	55.7 abcde	455.8 m
M350	8.9 hijkl	8.6 hijkl	12.7 cd	41.7 n	714.7 cdefghi
MG50-10A(G)	7.5 ghi	11.6 a	11.7 defg	56.7 ab	783.4 bcd
MG50-10A(Y)	7.5 ghi	10.3 abcde	10.7 g	56.5 abc	762.6 bcdefgh
MD15-2	7.0 hi	11.6 ab	14.0 ab	53.8 bcdefg	672.3 cdefghijk
V-2184	9.7 bcd	9.7 cdefghikl	12.2 def	57.0 a	791.6 bc
V-2773	11.7 a	7.9 m	12.5 de	43.2 n	772.8 bcdef
C.V.	8%	8.15%	5%	3.2%	10%

[1] Means followed by a common letter are not significantly different at 5% level (DMRT).

duction of more and heavier seeds. Heavy seeds might also be advantageous in terms of propagation. Kalton *et al.* (1959), as cited by Mitchell (1970), found that, in general, the heaviest seeds within a lot produced the most vigorous seedlings. Large-seeded strain within a species emerged faster from deeper planting and produced better stand than small-seeded strain. Freg and Wrigger (1956), as cited by Mitchell (1970), noted that plants from light seeds were smaller even after several weeks of growth.

Dry Bean Yield (kg/ha).

Although several mungbean varieties with potential yields of 1.0 to 1.5 metric t/ha of dry beans had been released by the Bureau of Plant Industry and U.P. at Los Baños since 1969, the national average yield has remained below 1.0 mt/ha, ranging from 0.4 to 0.6 mt/ha from 1954 to 1975. The promising mungbean varieties recommended by PCARR (1977) are MG50-10A-G, EG Glabrous #3, and CES ID-21, with potential yields ranging from 1.0-1.5 mt/ha.

Compared with the national average yield of 0.5 mt/ha in 1975, the yields of the 16 mungbean varieties studied under ViSCA conditions during the wet season ranged from 433.4 kg/ha to 916.4 kg/ha (Table 2).

CES ID-21 (916.4 kg/ha), which was significantly the highest yielder, appears promising under ViSCA conditions. This was followed by CES N30, V-2184, MG50-10A-G, CES 1G3, V-2773, and MG50-10A-Y which had statistically similar yields ranging from 762.6 to 867.3 kg/ha. The lowest yields were obtained from CES 87, EGMY 161-1, EGMY 377-21, and EGMY 17 with statistically similar yields ranging from 433.4 to 513.6 kg/ha. The others had intermediate yield levels.

The yields of those varieties mentioned above were influenced by their yield components. Some varieties, like MG50-10A-G, were poor in some characters such as fewer pods per plant, but were compensated by their performance in other components, like the production of bigger and heavier seeds and resistance to diseases and insect damage.

Incidence of Insect Pests and Diseases.

The common insect pests observed were beanfly *(Melanagromyza phaseoli)*, flea beetle *(Longitarsus manilensis* Weise), and short-horned grasshopper *(Atractomorpha psittacina* Hann). MG50-10A-G was noted to be highly resistant to the attack of these insects, although they did not seriously damage mcst of the varieties except those which were very susceptible like CES IF5.

The prevalent diseases observed during the entire duration of the experiment were cercospora leaf spot *(Cercospora canescans)* and leaf rust *(Uromyces phaseoli)*, both caused by fungi. Symptoms of cercospora leaf spot started to appear at the onset of flowering stage and infection was observed until the plants matured. EGMY 161-1 and CES 2C-1 were observed to be susceptible to this disease while CES ID-21 and M350 were not infected at all. Leaf rust was noted to infect the plants one week after flowering up to maturity. M350 was observed to be highly susceptible.

Field observations indicated that the above-mentioned diseases especially cercospora leaf spot, caused premature drying of the leaves and eventually defoliation. Thus, severe infection can be safely assumed to have reduced the grain yields of the affected varieties.

Table 3. Lodging performance of 16 mungo varieties planted in the open field (wet season).

Variety	Lodging Rating [1]
CES 2C-1	2.7
CES 87	2.2
CES N30	2.7
CES IF5	2.2
CES ID-21	1.2
CES IG3	1.0
EGMY 17	2.5
EGMY 377-21	3.5
EGMY 174-3	4.2
EGMY 161-1	3.5
M350	4.5
MG50-10A(Y)	4.2
MG50-10A(G)	3.7
MD15-2	3.5
V-2184	1.2
V-2773	4.2

[1] Lodging was rated as follows:
1-Almost all plants erect.
2-All plants leaning slightly or few plants down.
3-All plants leaning moderately (45°) or 25% to 50% of the plants down.
4-All plants leaning considerably, or 50% to 80% of the plants down.
5-Almost all plants down.

Incidence of Lodging.

Due to long, heavy rains which occurred frequently during the duration of the experiment, most of the plants lodged (EGMY 174-3, MG50-

10A-Y, and M350) except a few which were resistant such as CES IG3, CES ID-21, and V-2184 (Table 3).

Lodging is important since it could have been one of the causes of low grain yield of some varieties like EGMY 174-3 (7-.4 kh/ha) and M350 (714.7 kg/ha). Lodging also caused the plants to succumb to pest attack; hence, contributing to low yield.

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