Research Journal of Agriculture and Biological Sciences, 2(4): 162-165, 2006

Double Purpose (Forage and Seed) of Mungbean Production 1-Effect of Plant Density and Forage Cutting Date on Forage and Seed Yields of Mungbean (*Vigna radiata* (L.) Wilczck).

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Abstract: Two field trials were implemented during summer of 2004 and 2005 seasons at private farm, Al Nagah village, South Al-Tahrir province, Al Behaira Governorate, Egypt. The aim of study was to quantify and qualify both forage and seed yields of local mungbean variety (Kawmy-1) under 3 plant densities low density (LD), medium (MD), high (HD) which were 25, 43, 62 plant/m^2 and 3 forage cutting date 45,55,65 days after sowing (DAS). Results indicated that due to plant density HD 62 plant/m^2 produced the highest forage fresh yield with highest dry matter% and harvest index-MD 43 plant/m^2 produced highest no. of pods/plant, seed yield/plant,/ha, bio-yield/ha-LD 25 plant/m^2 was the best in no. of branches/plant, seed index, protein% in forage and in seeds. Due to forage cutting date plants were cut 45 DAS produced highest no. of branches, pods/plant, seed index, seed yield/plant,/ha, bio-yield/ha, protein% in seeds. Latest cut date 65 DAS gave the highest forage fresh yield, dry matter%, protein% and harvest index. Interaction of 43 plant/m^2 X45 DAS came in the 1st order in branches/plant, protein% in seeds. HDx65 DAS was the best in forage fresh yield/ha, dry matter% and harvest index. LD x 65 DAS was the best in forage protein%.

Key words: Mungbean-plant density-forage cutting date.

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilczek) is a summer pulse crop with short duration (70-90 days) and high nutritive value. The seeds contain 22-28% protein, 60-65% carbohydrates, 1-1.5% fat, 3.5-4.5% fibers and 4.5-5.5 ash, it has many effective uses, green pods in cooking as peas, sprout rich in vitamins and amino acids. It can produce a large amount of biomass and recover after grazing to yield abundant seeds. It can be used in intercropping system with maize [1-12-7], with sorghum[2] and between young trees for four years prior to canopy closure[14]. Also it can be good forage with cowpea under rainfall conditions[3]. Mungbean seeds can be used in broilers diets as non-traditional feed-stuff[8].

In Egypt during winter season the cultivated area occupied by forage crops are about 2.57 and 2.55 million feddan (2002 and 2003), there were a shortage during summer season. Alongside, only 0.045 and 0.055 million feddan alfalfa as continuous forage crop. Small holder farmers tries to fill these gap by maize and sorghum leaves cut as alternative to forage but it is not enough to their requirements and it cause sharp decrease in maize and sorghum grain yield. Although mungbean is gown mostly for seed production, its potential as a dual-purpose crop (early season forage production followed by seed production) is not lighted. Thus, double use (forage+seed) of mungbean can be low input technology and low-cost alternative to summer forage in Egypt[5].

Plant density has great effect on mungbean forage yield[12], on seed yield[8]. Forage yield remained relatively constant across wide variations in plant populations[3,11] take highest yield from high density 45 plant/m^2[18] stated that high plant density 28 plants/m^2 increased DM production/unit area, seed yield, no. of pods, 1000 seed weight but had little effect on number or weight of seeds/pod[15] reported that 50 plants/m^2 produced highest seed yield/ha compared to 22, 33, 42, 66 plants/m^2[16] Stated the superiority of 30 plants/m^2 in seed yield/ha, whereas, yield/plant, pods/plant decreased[13,18]. Concluded that 33 plants/m^2 gave yield of 1.87 t by 23% increased compared to low density[9]. Stated that high density 0.66 million plant/ha increased percentage ground cover[10]. Recorded yield increase in irrigated and unirrigated plots due to high density.

The aim of study was to quantify and qualify both forage and seed yields of 1ocal mungbean c.v Kawmy-1 to concerning the capabilities of mungbean as a dual-purpose crop (forage and seeds) under different plant densities forage and cutting dates.

Fedden = 4200 m^2

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MATERIALS AND METHODS

Two field experiments were conducted during the summer of 2004 and 2005 seasons at private farm, Al Nagah village, Al Tahadi sector, south Al-Tahrir province, Al Behaira Governorate, Egypt. The experimental soil was analyzed according to the method described by[4]. Soil texture was sandy having the following characters sand 94%, silt 5%, clay 1%, P^H 8.1, organic matter 0.70%, Ca Co_3 3.15%, EC 0.7 mmhos/cm^3, (N_4-P1.7-K 6.2) mg/100 g soil. Mungbean (*Vigna radiata* L. Wilczek) seeds local c.v (Kawmy-1) sown in the first week of May 2004 and 2005 seasons after inoculated by specific strain of *Rhizobium leguminosarum*. Experimental plot was 21 m^2 (10 ridges, each 3m in length and 0.70 m in width) in hills 0.10 m apart. Organic manure added at the rate of 24 m^3 farmyard manure (FYM)/hectare, P74 as calcium superphosphate 15.5% P_2O_5 were added before sowing. N48/ha as ammonium nitrate 33% N, K 57.6 as potassium sulphate 48% K_2O were added after forage cut. The experiments were laid out in split plot design with 4 replicates, the main plots were occupied by 3 plant densities.

- Low (LD), 10 cm between hills at one side of ridge.
- Medium (MD), 10 cm between hills at both sides of ridge.
- High (HD), 10 cm between hills at both sides and at top of ridge.

Three forage cut dates 45, 55, 65 days after sowing DAS were arranged randomly in sub-plots.

The experimental treatments were combinations between 2 factors

A-plant density:

- Low density (LD), 25 plant/m^2 = 250000 plant/hectare
- Medium density (MD), 43 plant/m^2 = 430000 plant/ha.
- High density (HD), 68 plant/m^2 = 680000plant/he.

Number of plants/m^2 were determined by random sample taken from each treatment in all replicates then counted plants gave plants/m^2 multiply x 10000=plants/hectare at forage cutting date.

B-Forage cutting date: Three dates 45, 55, 65 days after sowing (DAS). All the plants of each plot were cut 10cm above ground then weighted to determine forage fresh yield (ton/ha), sub sample of 1m^2, dried in oven to determine dry matter, protein%, according to method of[4]. Mungbean plants after forage cut were left to recover to abundant seeds. At harvest 100 DAS ten plants from the 2 central rows in each plot were taken randomly to estimate the yield components as follows: 1-number of branches/plant. 2-No. of pods/plant 3-1000 seeds weight (seed index) 4-seed yield/plant (g). Whole plot was harvested to determine seed yield and biological yield/ha. Harvest index = seed yield/biological yield. Total N in seeds was determined according to[4] percent crude protein was calculated by multiplying percent N by the conversion factor of 6.25.

All the data were statistically analyzed according to[17]. The combined analysis was conducted for the data of two seasons. The least significant differences (LSD) was used to compare means.

RESULTS AND DISCUSSION

A-Effect of plant density: Data presented in Table 1 show that there were significant differences between low density (LD), medium (MD) and high density (HD) in all attributes except for no. of pods/plant, seed, bio-yields/ha and harvest index. high density (HD) 62 plant/m^2 produced highest forage fresh yield ton/ha, dry matter% and harvest index, results were in accordance with obtained by[9-12] (MD) 43 plant/m^2 surpassed LD and HD in no. of pods/plant, seed yield either/plant or/ha, bio-yield/ha and harvest index [(11)] recorded highest seed yield from 45 plant/m^2 also[15-8] with 50 plant/m^2. Low density (LD) 25 plant/m^2 came in the first order in no of branches/plant, seed index also, protein% either in forage or in seeds, results were confirm with obtained by[19]. B-Effect of forage cutting date: Table 2 show significant, differences between 3 forage cutting dates early (45 DAS), Medium (55 DAS) and late (65 DAS). for all attributes except for harvest index. Due to forage yield late cutting date (65 DAS) produced highest fresh yield, dry matter% and protein%, also, it came in the 1st order in harvest index. The same trend was recorded in seed yield and its components early cutting date (45 DAS) had superiority in no. of both branches, pods/plant, seed index, seed yield either/plant or/ha, bio-yield/ha and protein% in seeds. C-Effect of interaction plant density x forage cutting date. It is clear from data presented in Table 3 that the differences between interactions were significant in all attributes except for harvest index the maximum forage fresh yield/ha which contain the highest dry matter% recorded by interaction of 62 plant/m^2 x 65 DAS cutting date, also, the same result in harvest index. Interaction of 43 plant/m^2 x 45 DAS came in the first order in no. of pods/plant, seed index and produced the greatest seed yield either/plant or/ha and bio-yield/ha. The highest no. of branches/plant and protein% in seeds were recorded by 25 plant/m^2 x 65 DAS, also, came in the first order in protein% in forage.Conclusion.

Table 1: Effect of plant density on forage, seed yields and its components (combined analysis of 2004 and 2005 seasons).

Characters / plant density	Forage Fresh yield (ton/ha)	Forage Dry matter (%)	Forage Protein (%)	Branches /plant	No. of pods /plant	Seed index	Seed yield g/plant	Seed yield (ton/ha)	Bio-yield (ton/ha)	Harvest index (%)	Protein % in seeds
25 plant /m^2	22.6	17.25	17.52	4.16	35.44	3.74	6.35	1.62	7.99	20.28	23.42
43 plant /m^2	25.2	17.42	16.77	3.62	39.11	3.69	8.83.	1.62	7.99	20.31	23.14
62 plant /m^2	28.2	18.81	16.65	2.84	32.44	3.62	7.88	1.57	7.72	20.41	22.82
LSD (0.05)	0.54	0.26	0.21	0.2	N.S	0.01	0.35	N.S	N.S	N.S	0.05

Table 2: Forage, seed yields of mungbean as affected by forage cutting date (combined analysis of 2004 and 2005 seasons).

Characters / Cutting date	Forage Fresh yield (ton/ha)	Forage Dry matter (%)	Forage Protein (%)	Branches /plant	No. of pods /plant	Seed index	Seed yield g/plant	Seed yield (ton/ha)	Bio-yield (ton/ha)	Harvest index (%)	Protein % in seeds
45 DAS	24.28	16.93	16.78	3.78	41.22	3.84	9.47	1.73	8.54	20.25	23.21
55 DAS	25.24	17.42	16.92	3.58	35.55	3.69	8.26	1.68	8.33	20.25	23.11
65 DAS	26.53	19.13	17.24	3.25	30.22	3.52	7.33	1.4	6.83	20.5	23.06
LSD (0.05)	0.65	0.18	0.28	0.1	6.01	0.1	0.41	0.12	0.49	N.S	0.04

Table 3: Forage, seed yields as affected by interaction of plant density x forage cutting date (combined analysis of 2004 and 2005 seasons).

Plant density plant/m^2	Cutting date	Forage Fresh yield (ton/ha)	Forage Dry matter (%)	Forage Protein (%)	Branches /plant	No. of pods /plant	Seed index	Seed yield g/plant	Seed yield (ton/ha)	Bio-yield (ton/ha)	Harvest index (%)	Protein % in seeds
25	45	20.9	16.2	17.2	4.3	42.3	3.8	9.2	1.71	8.52	20.12	23.5
	55	22.5	16.6	17.3	4.2	35	3.7	8.2	1.68	8.33	20.24	23.4
	65	24.5	18.9	18	4	29	3.6	7.6	1.46	7.13	20.48	23.3
43	45	24.2	16.4	16.6	3.8	43	3.8	10.2	1.76	8.71	20.31	23.2
	55	25.3	16.8	16.8	3.7	39	3.7	8.6	1.69	8.38	20.11	23.1
	65	25.9	19	16.9	3.3	35.3	3.5	7.7	1.41	6.9	20.51	23.1
62	45	27.7	18.2	16.5	3.2	38.3	3.8	9	1.71	8.41	20.34	22.9
	55	27.9	18.8	16.6	2.8	32.6	3.6	8	1.69	8.28	20.4	22.8
	65	29	19.3	16.8	2.4	26.3	3.4	6.7	1.32	6.46	20.51	22.7
LSD (0.05%)		1.13	0.96	0.5	0.16	10.4	0.02	0.72	0.17	0.8	N.S	0.07

Although mugbean is grown mostly for seeds production, its potential as a dual-purpose crop (early season forage production followed by seed production) is not lighted except few studies[3,5-9] mungbean c.v Kawmy-1 can produce forage fresh yield (29 ton/ha) with dry matter (19.3%) contain (16.8%) protein at 65 DAS followed by seed production (1.32 ton/ha) 22.7% protein at 100 DAS by using plant density of 62 plant/m^2. When seeds production was the main object it can produce 24.26 ton/ha forage fresh yield 16.4% DM and 16.6% protein at 45 DAS and 1.76 ton/ha seeds contain 23.2% protein at 100 DAS. The potential of mungbean c.v Kawmy-1 as a dual-purpose crop (early season forage production followed by seed production) is low input technology to narrowing the gap in summer forages under Egyptian conditions.

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