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A new annual summer forage crop: Cowpea

I. Ayan[1], M. Can[1], S. Arslan[1], Z. Acar[1] and H. Mut[2]

[1]Agriculture Faculty of Ondokuz Mayis University, Field Crops Department, Samsun (Turkey)
[2]Agriculture Faculty of Bozok University, Field Crops Department, Yozgat (Turkey)
e-mail: ilknuray@omu.edu.tr

Abstract. Four cowpea genotypes (YBS1, YBS2, YBS3, YBS4), were evaluated for forage yield and related parameters at two locations (Samsun and Suluova) in Turkey during 2011 summer growing season. The effects of genotype, location and GxL interaction on 50% flowering stage, fresh and dry forage yield were significant. Average value of the 50 % flowering period and dry forage yield were 49 days and 688 kg/da over the locations and genotypes. The period of 50% flowering among genotypes was longer, however, forage yield was higher at Suluova than Samsun. The highest dry and forage yield was obtained from genotype YBS3 which is also latest in flowering at both locations.

Keywords. Cowpea – Flowering period – Forage yield – Genotype.

Une nouvelle culture annuelle fourrage d'été : la niébé

Résumé. *Quatre génotypes de niébé (YBS1, YBS2, YBS3, YBS4), ont été évaluées pour le rendement en fourrage et les paramètres associés à deux endroits (Samsun et Suluova, en Turquie) au cours de la saison de croissance estivale de 2011. Les effets du génotype, de l'emplacement et de l'interaction GXL sur le rendement en fourrage frais et sec à 50% de floraison, étaient significatives. Les valeur moyennes de la période de floraison à 50% et du rendement en fourrage sec étaient 49 jours et 688 kg/da comprises tous les emplacements et les génotypes. La période de floraison à 50% chez était plus longue chez les génotypes, et cependant, le rendement en fourrage était plus élevé à Suluova qu'à Samsun. Le rendement le plus élevé en fourrage sec a été obtenu à partir du génotype YBS3 qui est aussi de floraison tardive sur les deux sites.*

Mots-clés. *Niébé – Période de floraison – Rendement fourrager – Génotype.*

I – Introduction

Cowpea *(Vigna unguiculata. L),* in Turkish "*Borulce"* is an important tropical and subtropical annual legume. White seeded and black-eyed types are generally grown for grain or vegetable while viny varieties are preferred for forage (Ali *et al*., 2004). Cowpea is heat- and drought- tolerant crop and it tolerate alkaline soil conditions and has a high potential of biological nitrogen fixation. Cowpea fodder is rich in crude protein up to 18.4% (Khan *et al*., 2010).

The biggest technical constraint in livestock production in Turkey is forage deficiency especially during summer period when pasture vegetation is dry. Cowpea can make a significant contribution to the forage production and to close forage gap during the summer period, however, its uses as forage has been neglected and, progress in breeding cultivars for forage purposes has been slow in Turkey. This crop is grown only for human consumption with production of 2200 tons grain and 26.000 tons fresh pod in the country. Therefore our knowledge on the forage performance of cowpea is insufficient and the present study was conducted to determine forage yield and yield-related parameters of four cowpea genotypes at two locations in Turkey.

II – Materials and methods

Four cowpea genotypes (YBS1, YBS2, YBS3, YBS4), were evaluated for forage yield and related parameters at two locations (Samsun and Suluova) in 2011. General properties of the experimental soil were given in Table 1. Experiments were arranged in randomized complete block design with five replicates and, established on June 8 in Samsun and on May 9 in Suluova. Both experiments were irrigated five times when plants need water.

Table 1. General properties of the experimental area soil

Location	Property						
	Clay (%)	Sand (%)	Silt (%)	OM (%)	pH	K (ppm)	P (ppm)
Samsun	53.74	24.83	21.43	2.87	7.08	31	26.61
Suluova	43.05	29.78	27.53	3.28	7.52	132	82.54

Plant height, main stem diameter, branch number and forage yield were determined at 50% flowering stage. For the dry forage yield fresh plant samples were oven-dried at 60° during 48 hours. The data were subjected to analysis of variance and Duncan's complementary test by means of SPSS 10.0 V.

III – Results and discussion

Average performance of cowpea genotypes for the yield and the other investigated traits over two locations are given in Table 2. The analysis of variance for combined locations showed that the effects of genotype (G), location (L) and GxL interaction on the investigated traits were generally significant ($P<0.05$, $p<0.01$). Therefore the results were given separately for Samsun (Table 3) and Suluova (Table 4) locations as well. Average value of the days to 50% flowering (DFL) among genotypes ranged from 45 to 55 days with the earliest genotype YBS4 over the locations,(Table 2). Average fresh forage yield (FFY) and dry forage yield (DFY) over the locations and genotypes were 3513 and 688 kg/da. The DFY determined in present study was higher than reported by Eskandari and Ghanbari (2009), who is obtain 613 kg/da DFL from cowpea. As a mean of two locations, the highest plant height (PH), FFY and DFY were deteremined in genotype YBS3 (Table 1). Average DFL was markedly earlier at Samsun location than Suluava, however, average FFY and DFY were higher at Suluova location (Table 2). Higher forage yield at Suluova than Samsun location might be due to high organic matter, sand and silt contents in the soil (Table 1) and aslo due to late flowering (Table 2). Highest yields of forage are obtained in sandy loam soils with high nitrogen rates resulting in excessive vegetative growth (Ali *et al*., 2004).

At Samsun location, DFL among genotypes ranged from 35 days (YBS4) to 46 days (YBS3). Main stem diameter (STD) and branch number was between 8.07-8.70 mm and 4.02-4.62 respectively with no significant differences among to genotypes at Samsun location (Table 3). The differences among genotypes for FFY and DFY were significant ($p<0.05$) and the high yielding genotype was YBS3 with 4128 kg/da fresh and 804 kg/da dry forage yield in this location (Table 3). At Suluova location, the genotypes took significantly longer period for the DFL compare to Samsun ranging between 54 and 63 days with the latest genotype YBS3 (Table 4). The effects of genotype were significant on PH, BRN, FFY and DFY and, genotpye YBS3 had a highest PH, BRN, FFY and DFY at Suluova location. The fresh and dry forage yield of genotype YBS3 were 4666 and 948 kg/da, respectively. Aravindan and Das (1996) found that forage yield was significantly and positively associated with branch number.

Table 2. Average performance of cowpea genotypes over the locations

Genotype	DFL (day)	PH (cm)	STD (mm)	BRN	FFY (kg/da)	DFY (kg/da)
YBS1	48ab	136ab	8.77	4.00	3478b	687b
YBS2	48ab	130ab	8.26	3.73	3140c	606c
YBS3	55a	147a	8.74	4.22	4397a	876a
YBS4	45b	118b	8.57	3.73	3038c	586c
SAMSUN	41	155	8,36	4,28	3413	650
SULUOVA	56	110	8.80	3.57	3613	727
Average	49	133	8.58	3.92	3513	688
Genotype (G)	**	**	**	**	**	**
Location (L)	**	**	*	**	**	**
G x L	**	**NS**	**NS**	*	**	**

*P<0.05, **P<0.01, NS: no significant. There are no significant differences (p<0.05) among mean indicated by the same letters. DFL; days to 50% flowering, PH, plant height, STD; stem diameter, BRN; branch number, FFY; Fresh forage yield, DFY; dry forage yield.

Table 3. Average performance of cowpea genotypes at Samsun location

Genotype	FLW	PH	STD	BRN	FFY	DFY
YBS1	42	155ab	8.70	4.26	3276b	631b
YBS2	42	155ab	8.07	4.24	3142b	581b
YBS3	46	170a	8.28	4.62	4128a	804a
YBS4	35	140b	8.40	4.02	3107b	585b

There are no significant differences (p<0.05) among meand indicated by the same letters DFL; days to 50% flowering, PH, plant height, STD; stem diameter, BRN; branch number, FFY; Fresh forage yield, DFY; dry forage yield.

Table 4. Average performance of cowpea genotypes in Suluova location

Genotype	FLW	PH	STD	BRN	FFY	DFY
YBS1	54	117a	8.84	3.78a	3680b	742b
YBS2	54	104b	8.45	3.22b	3138c	631c
YBS3	63	125a	9.19	3.82a	4666a	948a
YBS4	54	96b	8.73	3.44ab	2969c	587c

There are no significant differences (p<0.05) among meand indicated by the same letters DFL; days to 50% flowering, PH, plant height, STD; stem diameter, BRN; branch number, FFY; Fresh forage yield, DFY; dry forage yield.

Overall, at both location, genotype YBS3 was a latest for DFY and also superior for PH and yield. This results clearly showed that YBS3 is a superior genotype for forage production at both location. In addition present results indicated that long DFL period promoted the vegetative growth and resulted high forage yield. Similar results reported by Latif (1993). Also, Khan *et al*. (2010) observed high variation for PH in 24 genotypes ranging between13-236 cm and reported that there is a positive relationship between plant height and maturity period. It is meaning that earliest genotypes produced dwarf plants having low vegetative growth and forage yield.

IV – Conclusions

This study showed that the performance of cowpea as a forage crop is very high and it can take a significant role in closing the forage gap occurring especially during summer period. According to the differences between locations and genotypes for yield we suggest that there is need more study to determine superior genotypes for different conditions and also breeding studies to improve new varieties for target ecological zones.

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