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Effect of Dates of Sowing and Haulm Cutting on Growth and Yield of Fodder Cowpea

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A B S T R A C T

A field experiment was conducted during *kharif* 2017 at ICAR- Indian Grassland and Fodder Research Institute, Southern Regional Research Station, Dharwad to study the effect of dates of sowing and haulm cutting on seed yield and quality of fodder cowpea. The treatments imposed include three dates of sowing (S_1: Sown on June 15th, S_2: Sown on July 15th and S_3: Sown on August 15th) and four levels of cutting (C_1: No cutting, C_2: Haulm cutting at flower initiation, C_3: Haulm cutting at five days after flower initiation and C_4: Haulm cutting at ten days after flower initiation). The results revealed that, significantly maximum plant height (202.93 cm), number of branches (12.07), number of leaves (59.67) was noticed in 15th June sowing with no cutting and more number of days to flower initiation (80.00), days to 50 per cent flowering (85.50), days to maturity (120.00), higher green fodder yield (30.58 t ha^{-1}) and dry fodder yield (5.95 t ha^{-1}) was noticed in 15th June sowing with haulm cut at 10 days after flower initiation.

Introduction

Cowpea (*Vigna unguiculata* L.) is the most important legume in the world. It is used as fodder, vegetable, pulse and green manure crop. Pulses, popularly known as "poor man's meat", constitute the major source of dietary protein of large section of vegetarian population of the world. On an average, pulse contains 20 to 30 per cent protein. Apart from their high nutritional value, they have a unique characteristic of maintaining and restoring soil fertility through biological nitrogen fixation as well as complete defoliation adding to soil as organic manure thus play a vital role in a sustainable agriculture (Asthana, 1998).

Proper sowing time is the most important non-monetary input in crop production, which affects the crop growth, yield and quality to greater extent. Time of sowing plays an important role to fully exploit all available resources for growth as it provides optimum growing conditions such as temperature, light, humidity and rainfall. Sowing time determines time available for vegetative phase before the onset of flowering, which is mainly influenced by photoperiod. Delay or early sowing may or may not provide the optimum conditions of climate, which results in reduced growth and ultimately affect the yield and quality of produce. A little variation in sowing time leads to significant changes in performance of the crop. Climate has been changing world over including rainfall onset and distribution has changed and negatively affecting crop productivity in most parts of the world. This has adverse effect on the optimum planting time of crops and results in reduction in the yield.

In almost all legume crops, the asynchrony in pod maturation is a main problem which affects the sustainable agriculture. Many studies were undertaken to overcome this problem and to get synchronized maturity of pods, uniform plant type and seed yield. However, very few studies in different crops were carried out on the influence of haulm cutting on fodder yield and seed yield of cowpe to elucidate the effect of different levels of cuttings on different growth and yield attributing characters. Also the cutting process plays an important role in canopy photosynthesis and source and sink carbohydrates. Hence, the manipulation of plant canopy was undertaken to achieve the non-destructive light enrichment by exposing plant rows to greater light condition. Since, it's the era of dual purpose (fodder yield and seed yield) varieties, experiment on sowing date and haulm cutting will be of great crop in mitigating the fodder (Legume) shortage in the region.

Materials and Methods

The field experiment was carried out at the ICAR- Indian Grassland and Fodder Research Institute (IGFRI), Southern Regional Research Station, Dharwad during *kharif* 2017 to evaluate the effect of dates of sowing and haulm cutting on seed yield and quality of fodder cowpea. The experiment was laid out in split plot design with seven treatment combinations *viz.*, (S_1: Sown on June 15th, S_2: Sown on July 15th and S_3: Sown on August 15th) and four levels of cutting (C_1: No cutting, C_2: Haulm cutting at flower initiation, C_3: Haulm cutting at five days after flower initiation and C_4: Haulm cutting at ten days after flower initiation) and replicated thrice. The fodder cowpea seeds (MFC-09-01) were collected from the IGFRI, Dharwad. The cutting of plants was imposed at 6 inches height from the ground. Ten randomly selected and tagged plants from the net plot were used to record the observations. Observations on plant height, branches, leaves, green fodder yield, dry fodder yield, number of pods per plant, seeds per pod, seed yield per plant, seed yield per hectare, germination (%), seedling vigour index and seedling dry weight were recorded. The growth parameters were recorded at the time of harvesting whereas seed yield and seed quality parameters were recorded after the harvest of the crop data recorded were subjected to the statistical analysis as per Panse and Sukhatme (1967).

Results and Discussion

The experiment consisted of three sowing dates *viz.*, sowing on June 15th, sowing on July 15th and sowing on August 15th as main plot and four cutting levels *viz.*, control (no cutting), haulm cutting at flower initiation, haulm cutting at 5 days after flower initiation and haulm cutting at 10 days after flower initiation as subplot.

Plant height, number of branches and leaves recorded at harvesting time were found to be significantly influenced by dates of sowing and cutting schedules (Table 1). The S_1 treatment recorded higher plant height (62.73 cm) whereas, it was lowest (49.54 cm) in the crop sown on August 15th (S_3). An increase in plant height might be due to coincidence of favorable weather conditions, such as temperature, light, soil moisture and humidity during active crop growth stage resulted in luxurious growth. The reduction in plant growth with late sowing compared to early sowing (June 15th) was due to less favorable conditions as noticed by Reddy *et al.*, (2007). In cutting treatment C_1 recorded higher plant height **(**182.66 cm) and lowest was recorded in treatment C_4 (11.52 cm). The maximum plant height was noticed with no cutting treatment (C_1) and minimum height was recorded with haulm cutting at 10 days after flower initiation (C_4). It clearly indicates that the plant height was considerably decreased with increased level of cuttings which could be due to suppressed shoot growth. These findings are in agreement with Shehu *et al.*, (2001) and in the interaction, the treatment combination S_1C_1 (June 15th with no cutting) recorded higher plant height (202.93 cm) whereas minimum plant height (9 cm) was recorded in treatment S_3C_4 (August 15th with haulm cutting at 10 days after flower intiation).

The maximum number of branches (6.79) was found in S_1 and minimum number of branches (5.50) was recorded in S_3. This might be due to higher plant height to bear more number of branches. This increase was attributed to luxuriant growth of the crop which influenced plant height and increased inter nodal number resulting in more number of branches. These results are in accordance with the results of Jadhav *et al.*, (2006) in castor. The treatment C_1 (No cutting) recorded the highest number of branches (11.00) and the lowest number of branches (3.70) were recorded in C_4 (Haulm cutting at 10 days after flower initiation). The number of branches was more in haulm cutting at flower initiation and decreased in subsequent cuttings. This haulm cutting effect resulted in production of more branches and restriction to vertical growth initially on account of effective translocation of hormones; particularly auxins which are being diverted to the potential and tertiary shoot buds which in normal conditions remain dormant (Sharma *et al.*, (2003) in pigeon pea. However, higher number of branches (12.07) was recorded in treatment combination (S_1C_1) and minimum number of branches (3.00) was recorded in S_3C_4.

S_1 (Sown on June 15th) recorded maximum number of leaves at harvest (25.04) and minimum number of leaves (22.01) was found in S_3. This might be due to higher plant height to bear more number of leaves. This increase was attributed to luxuriant growth of crop which influenced plant height and increased the inter nodal number resulting in more number of branches thereby increased the number of leaves. These results are in accordance with the results of Jadhav *et al.*, (2006) in castor. The maximum number of leaves **(**55.62) was recorded in C_1 whereas lowest number of leaves (12.00) was recorded in C_4. The number of branches decreased with increase in the age of plant and cutting treatments which has resulted in decreased the number of leaves. These results are in agreement with the results of Sharma *et al.*, (2003) in pigeon pea. In the interaction effect maximum number of leaves was recorded in treatment combination S_1C_1 (59.67) and minimum number of leaves (11.10) was recorded in S_3C_3.

Days to flower initiation, days to 50 per cent flowering and days to maturity recorded at harvesting time were found to be significantly influenced by dates of sowing and cutting schedules (Table 2). More number of days to flower initiation and 50 per cent flowering was observed in crop sown crop on June15th (68.74 and 74.83 days, respectively) over late sown crop on August 15th (63.88 and 69.23 days, respectively) because of prolonged vegetative phase and photoperiod than the late sown crop. These results are in consistence with the findings of Singh *et al.*, (2010), who have reported that, with delayed sowing, days to flowering as well as days to 50 per cent flowering reduced in all the genotypes of mungbean. Similar results were also obtained by Rhandzu (2007) and Rewainy (2012) who concluded that due to early sowing luxuriant growth occurred which hastened the reproductive phase in cowpea and paddy, respectively. Similarly late cutting (C_4) of plants at different levels took relatively more days to flowering (77.91) and 50 per cent flowering (82.36) compared to uncut crop (47.27 and 55.72 days, respectively). This might be due to advancement of days to flowering and 50 per cent flowering can be related to alter in the source-sink relationship there by advancing the reproductive phase. These findings are in agreement with Merwade (2000) and Bulla (2009) in chickpea. In the interaction effect more number of days to flowering (80.00) and days to 50 per cent flowering (85.55) was recorded in treatment combination S_1C_4 and minimum number of days to flowering (49.87) and days to 50 per cent flowering (58.08) was recorded in S_1C_1.

The dates of sowing and haulm cutting significantly influenced the days to maturity. The crop sown on June 15th took more days to maturity (109.82) as compared to crop sown on August 15th (100.18). This was due to occurrence of maximum and minimum temperature that probably accelerated the process of development; as a result, duration of 50 per cent flowering as well as physiological maturity might have varied. Early sown crop might have availed more growing degree days, photothermal units and heliothermal units at physiological maturity and with each delay in sowing date decrease in growing degree day, photothermal units and heliothermal units was observed. Hence crop sown during second fortnight of June recorded more number of days to attain maturity and it decreased in delayed sowing. These results are in agreement with the findings of Singh *et al.,* (2010), who reported that with delayed sowing, days to 50 per cent flowering as well as days to maturity were reduced in all the genotypes of mungbean. Similar results were obtained by Rhandzu (2007), differential planting dates has caused differences in flowering period among the cowpea genotypes. Cutting of plants at subsequent levels took relatively more days to maturity (114.33) in C_4 compared to no cutting. This may be ascribed to advancement of days to flowering and 50 per cent flowering and pod formation leading to late maturity of the crop. These results are in conformity with Datta *et al.,* (2005) in fenugreek. In the interaction effect more number of days to maturity was recorded in treatment combination S_1C_4 (120.00) and less number of days (87.17) was recorded in S_3C_1.

Green fodder yield and dry fodder yield, recorded at harvesting time were found to be significantly influenced by dates of sowing and cutting schedules (Table 3). The crop sown on June 15th (S_1) recorded maximum green fodder yield (29.47 t ha^{-1}) and it was lowest (20.61 t ha^{-1}) in S_3 treatment. The higher plant height, number of leaves and number of branches have significantly contributed to higher fodder yield. Since the net photosynthesis is dependent on higher amounts of photosynthates which might have been produced and attributed for higher forage yield. These results are in accordance with the results of Shehu *et al.,* (2001) they concluded that sowing of lablab crop in August recorded significantly lower yield attributes compared to the crop sown in June. Among cutting levels, C_4 recorded significantly maximum green fodder yield (25.76 t ha^{-1}) whereas minimum green fodder yield was recorded in C_1 (23.61 t ha^{-1}).

Table.1 Effect of dates of sowing and haulm cutting on plant height, number of branches and numbers of leaves at different growth stages of fodder cowpea

Treatment details	Plant height (cm)	Number of branches	Number of leaves
Dates of sowing (S)			
S_1: Sowing on June 15th	62.73	6.79	25.04
S_2: Sowing on July 15th	55.22	5.95	23.51
S_3: Sowing on August 15th	49.54	5.50	22.01
S. Em. ±	0.36	0.05	0.21
C. D. at 5 %	1.42	0.20	0.82
Levels of cuttings (C)			
C_1: Control (No cut)	182.66	11.00	55.62
C_2: Haulm cutting at flower initiation	16.47	5.60	14.22
C_3: Haulm cutting at 5 days after flower initiation	12.68	4.03	12.23
C_4: Haulm cutting at 10 days after flower initiation	11.52	3.70	12.00
S. Em. ±	0.30	0.09	0.47
C. D. at 5 %	0.91	0.28	1.39
Interaction (S × C)			
S_1C_1	202.93	12.07	59.67
S_1C_2	19.00	6.50	14.70
S_1C_3	15.00	4.50	13.30
S_1C_4	14.00	4.10	12.50
S_2C_1	180.72	10.43	55.23
S_2C_2	16.11	5.30	14.50
S_2C_3	12.50	4.08	12.30
S_2C_4	11.55	4.00	12.00
S_3C_1	164.34	10.50	51.97
S_3C_2	14.30	5.00	13.47
S_3C_3	10.53	3.50	11.10
S_3C_4	9.00	3.00	11.50
S. Em. ± for S at C levels	0.53	0.16	0.81
C at S levels	0.88	0.25	1.24
C. D. at 5 % for S at C levels	1.58	0.49	2.42
C at S levels	2.75	0.76	3.72

***Non significant

Table.2 Effect of dates of sowing and haulm cutting on days to flower initiation, days to 50 per cent flowering and days to maturity of fodder cowpea

Treatment details	Days to flower initiation	Days to 50 % flowering	Days to maturity
Dates of sowing (S)			
S_1: Sowing on June 15th	68.74	74.83	109.82
S_2: Sowing on July 15th	66.72	73.16	104.81
S_3: Sowing on August 15th	63.88	69.23	100.18
S. Em. ±	0.20	0.24	0.44
C. D. at 5 %	0.81	0.96	1.76
Levels of cuttings (C)			
C_1: Control (No cut)	47.27	55.72	89.50
C_2: Haulm cutting at flower initiation	67.92	73.56	105.15
C_3: Haulm cutting at 5 days after flower initiation	72.70	77.99	110.75
C_4: Haulm cutting at 10 days after flower initiation	77.91	82.36	114.33
S. Em. ±	0.42	0.16	0.40
C. D. at 5 %	1.26	0.50	1.20
Interaction (S × C)			
S_1C_1	49.87	58.08	92.17
S_1C_2	70.00	75.50	110.00
S_1C_3	75.10	80.25	117.11
S_1C_4	80.00	85.50	120.00
S_2C_1	47.40	55.50	89.17
S_2C_2	68.25	74.67	105.39
S_2C_3	73.00	79.00	110.67
S_2C_4	78.22	83.47	114.00
S_3C_1	44.53	53.58	87.17
S_3C_2	65.50	70.50	100.07
S_3C_3	70.00	74.73	104.48
S_3C_4	75.50	78.10	109.00
S. Em. ± for S at C levels	0.73	0.29	0.69
C at S levels	1.12	0.50	1.14
C. D. at 5 % for S at C levels	NS*	0.86	2.07
C at S levels	NS	1.14	3.56

significant

Table.3 Effect of dates of sowing and haulm cutting on green fodder yield and dry fodder yield of fodder cowpea

Treatment details	Green fodder yield (t ha^{-1})	Dry fodder yield (t ha^{-1})
Dates of sowing (S)		
S_1: First sowing on June 15th	29.47	5.81
S_2: Second sowing on July 15th	24.12	5.30
S_3: Third sowing in August 15th	20.61	4.78
S. Em. ±	0.14	0.02
C. D. at 5 %	0.58	0.10
Levels of cuttings (C)		
C_1: Control (No cut)	23.61	5.09
C_2: Haulm cutting at flower initiation	24.44	5.26
C_3: Haulm cutting at 5 days after flower initiation	25.12	5.36
C_4: Haulm cutting at 10 days after flower initiation	25.76	5.48
S. Em. ±	0.26	0.06
C. D. at 5 %	0.79	0.18
Interaction (S × C)		
S_1C_1	27.83	5.66
S_1C_2	29.25	5.78
S_1C_3	30.22	5.83
S_1C_4	30.58	5.95
S_2C_1	23.00	5.04
S_2C_2	23.58	5.30
S_2C_3	24.22	5.39
S_2C_4	25.67	5.48
S_3C_1	20.00	4.58
S_3C_2	20.50	4.69
S_3C_3	20.92	4.85
S_3C_4	21.03	5.01
S. Em. ± for S at C levels	0.46	0.10
C at S levels	0.70	0.16
C. D. at 5 % for S at C levels	NS*	NS
C at S levels	NS	NS

significant

The maximum green fodder yield was recorded in the haulm cutting treatment at 10 days after flower initiation (C_4) and minimum green fodder yield was recorded with no cutting (C_1).This indicated that dry fodder yield increases with increase in cutting interval which clearly indicates that delay in cuttings induce more number of branches which might have produced more number of leaves thus increased the fresh weight of foliage. These results are in conformity with Shehu *et al.,* (2001) in berseem crop. The interaction between dates of sowing and haulm cutting treatment (S_1C_4) recorded higher green fodder yield (30.58 t ha^{-1}) whereas it was minimum in S_3C (20.00 t ha^{-1}).

The treatment S_1 recorded significantly higher dry fodder yield (5.81 t ha^{-1}) whereas, minimum dry fodder yield (4.78 t ha^{-1}) was recorded in S_3 treatment. Dry matter accumulation per plan increased continuously with advancement in age of the crop till maturity. These findings are in conformity with the results of Vijaylaxmi (2012) in urdbean. Among cutting treatments higher dry fodder yield **(**5.48 t ha^{-1}) was recorded in C_4 and it was lowest (5.09 t ha^{-1}) in C_1. The dry fodder yield increased with increase in cutting interval. The increasing proportion of the stem fraction with increasing interval of cuts accounted for increasing dry matter percentage with increasing interval of cutting schedules. This is in accordance with the results of Wilman *et al.,* (1976) on perennial ryegrass. The interaction effect of S_1C_4 recorded higher dry fodder yield (5.95 t ha^{-1}) wheras, minimum dry fodder yield (4.58 t ha^{-1}) was recorded by S_3C_1.

On the basis of experimental research findings, it could be concluded that the sowing dates and cutting levels influenced the growth and fodder yield of fodder cowpea. Among the sowing dates, timely sowing (June 15th) with no cutting enhanced the growth and fodder yield. The crop sown on June 15th with cutting at 10 days after flower initiation enhanced the green fodder yield and dry fodder yield in fodder cowpea.

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