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Effect of different sowing windows and planting geometry on determinate and indeterminate cowpea genotypes under rainfed conditions

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Abstract
An experiment was conducted to study the determinate and indeterminate cowpea genotypes response under different sowing dates and planting geometry. Field trial was conducted during *kharif* 2013 under rainfed conditions at Main Agricultural Research Station, Dharwad. Experiment was laid out on split-split plot design with three replications. The experiment comprised of three dates of sowing (June second fortnight, July first fortnight and July second fortnight) in main plot, three row spacing's (30, 45 and 60 cm) in sub plot and two genotypes (DC 15 and C -152) in sub-sub plot. Results indicated that Early sowing (second fortnight of June) of cowpea genotype DC 15 with 45cm row spacing is beneficial to get higher seed and haulm yield (1343 and 2830 kg ha^{-1} respectively). Genotype DC 15 is a determinate type having uniform days to 50% flowering and physiological maturity of pods (57.3 and 84.3 days respectively) and also had higher protein content (24.26%) and yielding ability (1026 kg ha^{-1}) as compared to genotype C-152 (55.9 and 93.5 days, 21.33% and 887 kg ha^{-1} respectively).

Keywords: Determinate cowpea genotypes, sowing dates, row spacing, cowpea yield

Introduction

Pulses, popularly known as “poor man’s meat”, constitute the major source of dietary protein of the large section of vegetarian population of the world. On an average, pulses contain 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 sustainable agriculture (Asthana, 1998) [2]. Among the pulses, cowpea is one of the important versatile food legumes and a valuable component of the traditional cropping systems in the semi-arid tropics covering Asia, Africa and Central America. It is the most ancient human food crop. Its quick growth, rapid ground cover and nitrogen fixing ability (56 kg ha^{-1}) have made it an essential component of sustainable agriculture in marginal lands. The average minimum rainfall required for the crop is 300 mm over the growing season. It is ideally suited to tropical lowland, doing well in hot, dry and humid ecosystems (Nwokolo and Smart, 1996) [9]. It is an important multipurpose grain legume extensively cultivated in arid and semiarid tropics. Cowpea is grown as catch crop, mulch crop, intercrop, mixed crop and green manure crop. It can be utilized in various ways ranging from the use of young green seedling as vegetables and also forage for livestock to its consumption as beans, the green pods are used as vegetables (Ekpo *et al*., 2012) [5]. It is good source of protein (20-25 %), which is enriched by amino acids like lysine and tryptophan. It is very nutritious with free metabolites or other toxins (Kay, 1979) [7].

There are diverse cowpea genotypes demanding a site specific management approach which includes choice of proper planting date and a selection of best adapted genotype. Climate has been changing world over and negatively affecting crop productivity in most parts of the world. Rainfall onset and distribution has changed. This has an effect on the optimum planting time of crops and resulted reducing in yield because of inappropriate planting dates. The crop is adapted to harsh environments such as high temperatures and drought, but yield can be compromised by low or high rainfall regimes. Suitable time of sowing provides optimum growing conditions with favourable temperature, light, humidity and rainfall during crop growth period. This ultimately decides the selection of varieties for particular or different dates of sowing to stabilize or to get maximum yield. The changes to the onset of rainfall have necessitated a re-looked to the recommended planting dates of many crops since they are now unsuitable to prevailing rainfall patterns.

Despite the importance of cowpea in sustaining livelihood of the rural communities, seed yield of the crop has always remained low and variable. Poor production practices like choice of cultivar, adaptability as well as lack of information on the suitable planting date for new genotypes has contributed to low cowpea productivity. In this regard, attempts were made to develop a determinate, early maturing and high yielding genotype which results in development of genotype DC 15. In order to generate information on performance of this genotype to agronomic management practices particularly with respect to different sowing windows and planting geometry the present investigation is carried out

Material and Methods
An experiment was carried out to study the effect of sowing dates and planting geometry on days to flowering, physiological maturity, protein content and yield of two cowpea genotypes. The field trial was conducted during *kharif* 2013 under rainfed conditions at Main Agricultural Research Station, University of Agricultural sciences, Dharwad. The soil of experimental site was classified under Vertisols with 7.8 pH, EC of 0.32 dS m^{-1}. The available N, P_2O_5 and K_2O status of soil was 225.5, 31.9 and 330.5 kg ha^{-1} respectively. The experiment was laid out on split-split plot design with three replications. There are eighteen treatment combinations comprised of three dates of sowing (June second fortnight, July first fortnight and July second fortnight) in main plot, three row spacings (30, 45 and 60 cm) in sub plot and two genotypes (DC 15 and C-152) in sub-sub plot. In sub plot same seed rate was used to maintain the uniform plant population in all the three row spacings by adjusting intra row spacing. During crop period the total rainfall received was 740.4 mm distributed in 63 rainy days. The fertilizer dose of 25:50:25 N, P_2O_5 and K_2O kg ha^{-1} was applied in the form of Urea, DAP and MOP. Entire dose of fertilizers was applied as basal. Flowering and physiological maturity, disease incidence parameters were analysed for evaluation for genotypes.

Results
Days to 50 per cent flowering was significantly influenced by sowing dates (Table 1). More number of days to 50 per cent flowering was observed in early sown crop (second fortnight of June, 59.2 days) over late sown crop (second fortnight of July, 53.1 days) and it was on par with first fortnight of July (57.4 days). There was no significant differences were observed among planting geometry for flowering. Genotypes differed significantly to attain 50 per cent flowering. DC 15 took more days (57.30) to attain 50 per cent flowering than C-152 (55.85). However in DC 15 uniform flowering was observed as compared to C-152. None of the interaction effects were significant. Days to physiological maturity of pods differed significantly due to different sowing windows (Table 1). Crop sown during second fortnight of June recorded more number of days (92.2) to physiological maturity of pods as compared to first and second fortnight of July (89.7 and 84.8 respectively). There was no significant difference observed due to planting geometry. Genotypes differed significantly to attain physiological maturity of pods. DC 15 recorded less number of days (84.3) than C-152 (93.5). C-152 showed indeterminate growth habit and uneven maturity of pods where as DC 15 showed uniform maturity of pods and determinate growth habit. None of the interaction effects were significant. There was no significant difference in grain protein content was observed due to the dates of sowing. Similarly planting geometry also had no significant difference for grain protein content. Genotypes differed significantly with respect to seed protein content. DC 15 recorded significantly higher protein content (24.26 %) than C-152 (21.33 %). None of the interaction effects were significant.

Cowpea seed yield differed significantly among the dates of sowing (Table 2). The crop sown on second fortnight of June recorded significantly higher seed yield (1155 kg ha^{-1}) over first fortnight of July (1029 kg ha^{-1}) and second fortnight of July (686 kg ha^{-1}). Among the spacings, significantly higher seed yield was recorded in 45cm row spacing (1062 kg ha^{-1}) over 60 cm row spacing (774 kg ha^{-1}) and was on par with 30 cm row spacing (1034 kg ha^{-1}). Significant difference was observed in seed yield between two genotypes. Genotype DC 15 recorded significantly higher seed yield (1026 kg ha^{-1}) than genotype C-152 (887 kg ha^{-1}). None of the interactions effects were significant except dates of sowing × varieties and spacing × varieties. The interaction D_1G_1 (second fortnight of June and DC 15) (1239 kg ha^{-1}) was significantly superior to other interactions of dates of sowing and genotypes. The interaction S_2G_1 (45 cm row spacing and DC 15) (1140 kg ha^{-1}) was significant to other interactions of spacing and genotypes. The seed yield of cowpea was non-significant for dates of sowing, planting geometry and genotypes interactions. Among the treatment combinations, the variety DC 15 sown on second fortnight of June with 45cm row spacing ($D_1S_2G_1$) recorded maximum yield (1343 kg ha^{-1}) over other treatment combinations. The lower seed yield of cowpea (489 kg ha^{-1}) was noticed in crop sown on second fortnight of July, the variety C-152 with 60cm row spacing ($D_3S_3G_2$).

Haulm yield was significantly influenced due to sowing dates (Table 2). June second fortnight sown crop recorded significantly higher haulm yield (2535 kg ha^{-1}) than July second fortnight sown crop (1574 kg ha^{-1}) and it was on par with the crop sown during first fortnight of July (2350 kg ha^{-1}). Planting geometry recorded significant difference for haulm yield. Higher haulm yield was recorded in 45 cm row spacing (2373 kg ha^{-1}) and it was on par with 30 cm row spacing (2296 kg ha^{-1}) than 60 cm row spacing (1791 kg ha^{-1}). The genotypes also had significant difference for haulm yield. Higher haulm yield was noticed in genotype DC 15 (2279 kg ha^{-1}) than C-152 (2027 kg ha^{-1}) (Table). None of the interaction effects were differed significantly for haulm yield except dates of sowing and genotype. Genotype DC 15 sown on second fortnight of June (D_1G_1) recorded significantly higher haulm yield (2647 kg ha^{-1}) as compared to other interaction effects. However D_3G_2 (Second fortnight of July and C-152) recorded significantly lower haulm yield

Crop sown on second fortnight of June and first fortnight of July recorded significantly higher per cent HI (30.34 and 29.92 respectively) over the second fortnight of July sowing (28.86). Among the planting geometry, significantly higher HI was recorded in 30 and 45 cm row (30.17 and 29.98 respectively) over 60 cm (28.98). Significant difference in HI was also observed between genotypes. DC 15 recorded higher HI (29.98) than C-152 (29.43). None of the interaction effects were significant except dates of sowing and genotypes (Table 2). The crop sown on second fortnight of June with DC 15 recorded significantly higher HI (30.86) than other treatment combinations. Similarly, the dates of sowing and planting geometry interaction effects also significantly influenced the HI. Crop sown during second fortnight of June with 30 and 45 cm row spacings recorded significantly higher HI (30.80 and 30.93 respectively) than other dates of sowing and planting geometry interactions.

Discussion

Early sown crops took more days to flower because of prolonged vegetative phase and photoperiod than the late sown crop. The different trend was observed due to occurrence of higher 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 be varied. Early sown crop might have availed more growing degree days (GDD), photothermal units (PTU) and heliothermal units (HTU) at physiological maturity and with each delay in sowing GDD, PTU and HTU decreased. Hence crop sown during second fortnight of June recorded more number of days to attain physiological maturity of pods and it was decreased in delayed sowing. These results are in consistence with the findings of Guriqbal Singh *et al.* (2010) [6], 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) [11], reported that planting date cause differences in flowering period among the cowpea genotypes.

Meteorological data suggest that early sown crop benefited from monsoon rainfall during July and August (Table 3). The crop attained vigorous vegetative growth prior to onset of flowering that was later used for pod formation and grain filling. However the crop sown during first fortnight of July was severely infested by lepidopteron pests due to prevailed favourable conditions and also crop was susceptible for lodging. Late sown crop suffered from dry spells resulting in stunted growth. In addition relatively high diurnal fluctuation in temperatures associated with low night temperature might have hampered grain formation. Based on the observation it is concluded that prevailing common practice of cowpea sowing during second fortnight of July or even in late may cause substantial reduction in grain yield. There for early sowing (II fortnight of June) of cowpea is beneficial for obtaining higher yield especially for determinate genotypes. Between the cowpea genotypes, significantly higher grain protein content was recorded in DC 15 (24.36 %) over C-152 (21.33 %). Seed protein content is a genotype character which is genetically controlled. These results are in conformity with findings of Madhu (2013) [8]. None of the interactions effects were significant. Azarakhash *et al*. (2007) [3] opined that the grain protein content was not affected by different row and intra row spacings.

Time of sowing plays an important role to exploit genetic potentiality of a genotype as it provides optimum growing condition such as temperature, light, humidity and rain fall during crop growth stage. Sowing date determines the time available for vegetative phase before the onset of flowering which is mainly influenced by photoperiod. Among the agronomic practices in field crops, sowing at optimum time is an important non cash input that results in considerable increase in the yield. This indicates that a favourable soil and climatic conditions are important to the crop for the expression of their genetic potential. In present investigation D_1 produced 11 and 41 per cent higher grain yield over D_2 and D_3 respectively. The higher seed yield obtained in early sown crop was due to higher soil moisture during cropping period as a result of receipt of 97.2 and 134.6 mm rainfall during August and September respectively. This coincides with the flowering and pod formation stage of early sown crop and these results are in conformity with findings of Babalola (1980) [4] reported that the grain yield reduction was higher (36.8 %) when stress imposed at flowering and podding stage in cowpea. The genotype DC 15 recorded significantly higher yield than C-152.

Yield potential of a particular genotype in a given environment can be exploited under optimum planting geometry where competition between the plants is minimum. This can be achieved with optimum planting geometry which not only utilizes soil moisture and nutrients more effectively but also avoids excessive competition among the plants. Higher seed yield with row spacing of 45 and 30 cm could be attributed due to reduced competition between the plants, better utilisation of soil moisture and nutrients under prevailed climatic conditions. However, beyond a certain limit yield cannot be varied significantly. Hence, optimum row spacing allows the crop to achieve its potential yield. Shivananda (2005) [12] reported consequent upon improved growth and yield attributes significantly higher seed and haulm yields (1450 and 2626 kg ha^{-1}, respectively) were recorded with 45 x 10 cm than 30 x 10 cm and 60 x 10 cm. These results are also in agreement with the findings of Azarakhash *et al*. (2007) [3] in common bean. They found that inter and intra row spacings have significant influence on yield and yield components.

Performance of the genotypes is governed by many factors, which individually or in combination to determine the yield potentiality. Optimum LAI coupled with higher photosynthetic activity may lead to higher biomass production and further by way of partitioning of dry matter, a genotype can yield better. Thus, identification of all such favourable yield and growth components and their integration in one genotype lead to its better performance over other genotypes. DC 15 recorded significantly higher seed yield which was 14 per cent higher as compared to C-152. Such significant differences in genotypes with respect to seed yield have been reported by Shivananda (2005) [12] and Praveen Kumar *et al.* (2013) [10] in cowpea, Soomro and Khan (2003) [13] and Madhu (2013) [8] in mungbean. Abdur Rahman *et al*. (2004) [1] noticed that the AAU-39 was more potential yielding variety in all the four dates of sowing followed by ML-131.

Table 1: Days to 50% flowering, Days to physiological maturity and seed protein content of cowpea genotypes as influenced by sowing windows and planting geometry

Treatment		Row spacing (S)											
		Days to 50% flowering				Days to physiological maturity				Seed protein content (%)			
Date of sowing (D)	Genotypes (G)	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S1	S2	S3	Mean
D_1: II FN of June	G_1	60.3	60.7	59.7	60.2	87.3	87.0	85.3	86.6	24.33	24.40	24.17	24.30
	G_2	58.0	58.0	58.7	58.2	98.3	97.7	97.3	97.8	21.21	21.23	21.40	21.28
	Mean	59.2	59.3	59.2	59.2	92.8	92.3	91.3	92.2	22.77	22.82	22.78	22.79
D_2: I FN of July	G_1	57.3	58.3	58.7	58.1	86.0	85.3	84.7	85.3	24.53	24.32	24.00	24.29
	G_2	56.0	56.7	57.3	56.7	94.7	94.3	93.0	94.0	21.67	21.13	21.70	21.50
	Mean	56.7	57.5	58.0	57.4	90.3	89.8	88.8	89.7	23.10	22.73	22.85	22.80
D_3: II FN of July	G_1	55.0	53.0	52.7	53.6	81.3	79.7	81.7	80.9	24.15	24.23	24.13	24.18
	G_2	53.0	52.7	52.3	52.7	89.7	88.3	88.0	88.7	21.20	21.17	21.23	21.20

	Mean	54.0	52.8	52.5	53.1	85.5	84.0	84.8	84.8	22.68	22.70	22.68	22.7
Mean of G_1		57.6	57.3	57.0	57.3	84.9	84.0	83.9	84.3	24.34	24.32	24.10	24.26
Mean of G_2		55.7	55.8	56.1	55.9	94.2	93.4	92.8	93.5	21.36	21.18	21.44	21.33
Mean		56.6	56.6	56.6		89.6	88.7	88.3		22.84	22.75	22.73	
Sources		**S.Em +**	**CD (P = 0.05)**			**S.Em+**		**CD (P = 0.05)**		**S.Em +**		**CD (P = 0.05)**	
Date of sowing (D)		1.03	4.0			0.37		1.44		0.06		NS	
Row Spacing (S)		0.20	NS			0.38		NS		0.10		NS	
Genotype (G)		0.14	0.4			0.28		0.82		0.07		0.20	
D X S		0.34	NS			0.66		NS		0.17		NS	
D X G		0.24	NS			0.48		1.42		0.12		NS	
S X G		0.24	NS			0.48		NS		0.12		NS	
D X S X G		0.42	NS			0.83		NS		0.20		NS	

D = Date of sowing **S= Row Spacing** **G = Genotypes** **DAS=** Days after sowing

D_1= Second fortnight of June (26th June) S_1= 30 cm G_1= DC-15 **FN =** Fortnight

D_2= First fortnight of July (13th July) S_2= 45 cm G_2= C-152 **NS**= Non Significant

D_3= Second fortnight of July (30th July) S_3= 60 cm

Table 2: Seed yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and harvest index (%) of cowpea genotypes as influenced by sowing windows and planting geometry

Treatment		**Row spacing (S)**											
		Seed yield (kg ha^{-1})				**Haulm yield (kg ha^{-1})**				**Harvest index (%)**			
Date of sowing (D)	**Genotypes (G)**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**	**S_1**	**S_2**	**S_3**	**Mean**
D_1: II FN of June	G_1	1303	1343	1071	1239	2712	2830	2399	2647	31.70	31.44	29.46	30.86
	G_2	1100	1180	933	1071	2478	2597	2196	2424	29.90	30.43	29.11	29.81
	Mean	1202	1262	1002	1155	2595	2713	2298	2535	30.80	30.93	29.28	30.34
D_2: I FN of July	G_1	1228	1233	877	1113	2736	2809	2045	2530	30.51	30.15	29.52	30.06
	G_2	1030	1053	750	944	2384	2358	1768	2170	29.73	30.43	29.21	29.79
	Mean	1129	1143	813	1029	2560	2583	1907	2350	30.12	30.29	29.36	29.92
D_3: II FN of July	G_1	813	842	523	726	1831	1946	1205	1661	29.64	28.79	28.63	29.02
	G_2	727	720	489	645	1634	1697	1132	1488	29.52	28.62	27.94	28.69
	Mean	770	781	506	686	1733	1821	1168	1574	29.58	28.70	28.28	28.86
Mean of G_1		1115	1140	824	1026	2426	2528	1883	2279	30.61	30.12	29.20	29.98
Mean of G_2		952	984	724	887	2166	2217	1699	2027	29.72	29.83	28.75	29.43
Mean		1034	1062	774		2296	2373	1791		30.17	29.98	28.98	
Sources		**S.Em +**		**CD (P = 0.05)**		**S.Em+**		**CD (P = 0.05)**		**S.Em +**		**CD (P = 0.05)**	
Date of sowing (D)		18.7		73.6		52.3		205.4		0.11		0.43	
Row Spacing (S)		11.9		36.6		32.3		99.5		0.11		0.34	
Genotype (G)		5.1		15.2		14.4		42.9		0.08		0.23	
D X S		20.6		NS		55.9		NS		0.19		0.58	
D X G		8.9		26.4		25.0		74.3		0.13		0.40	
S X G		8.9		26.4		25.0		NS		0.13		NS	
D X S X G		15.4		NS		43.3		NS		0.23		NS	

D = Date of sowing **S= Row Spacing** **G = Genotypes** **DAS=** Days after sowing

D_1= Second fortnight of June (26th June) S_1= 30 cm G_1= DC-15 **FN =** Fortnight

D_2= First fortnight of July (13th July) S_2= 45 cm G_2= C-152 **NS**= Non Significant

D_3= Second fortnight of July (30th July) S_3= 60 cm

Table 3: Monthly meteorological data during crop growth period at the experimental site

Month	**Rainfall (mm)**	**Rainy days**	**Mean Temperature (°C)**	
			Maximum	**Minimum**
			2013	**2013**
January	0.0	0	31.2	14.5
February	2.2	0	32.6	16.8
March	42.0	1	35.3	19.2
April	10.0	1	36.9	20.2
May	124.6	6	35.5	21.8
June	75.4	10	28.0	20.8
July	177.8	17	25.4	20.3
August	97.2	10	26.7	19.9
September	133.6	13	26.5	20.2
October	75.4	5	28.8	19.4
November	2.2	0	29.0	15.8
December	0.0	0	28.4	12.7
Total	740.4	63	-	-

Conclusion

Early sowing (second fortnight of June) of cowpea genotype DC 15 with 45cm row spacing is beneficial to get higher yield. Genotype DC 15 is a determinate type having uniform days to 50% flowering and physiological maturity of pods and also had higher protein content and yielding ability as compared to genotype C-152.

References

1. Abdur Rahman SMD, Hasan Kabir MD, Mahfuza Begum, Abdus Salam. Yield performance of mungbean as affected by planting date variety and plant density. Journal of Agronomy. 2004; 3(1):18-24.
2. Asthana AN. Pulse crops research in India. Indian Journal of Agricultural Sciences. 1998; 68(2):448-452.
3. Azarakhash TJ, Amir FM, Addollah H, Shahin Y, Sahab R. Row spacing and inter row spacing effects on some agro-physiological traits of two common bean (*Phaseolous vulgaris* L.) cultivars. Pakistan Journal of Biological Science. 2007; 10(24):4543-4546.
4. Babalola O. Water relations of three cowpea cultivars (*Vigna unguiculata*, L.). Plant and Soil. 1980; 56:59-69.
5. Ekpo IA, Agbor RB, Osuagwu1 AN, Okpako EC, Ekanem BE. Evaluation of eight cowpea (*Vigna unguiculata* L. Walp) species for yield and associated traits. International Journal of Pure and Applied Biosciences. 2012; 12(2):1-7.
6. Guriqbal Singh, Sekhon HS, Hari Ram KK, Gill, Poonam Sharma. Effect of time of sowing on nodulation, growth, thermal requirement and grain yield of *kharif* mungbean genotypes. Journal of Food Legume. 2010; 23(2):132-134.
7. Kay W. Guidelines for the production of cowpea (*Vigna unguiculata*). Field Crop Abstracts. 1979; 27:301-312.
8. Madhu G. Response of mungbean (*Vigna radiata* L. Wilczek) genotypes to dates of sowing and foliar nutrition in *kharif* season. M. Sc. (Agriculture) Thesis, University of Agricultural Sciences, Dharwad, India, 2013.
9. Nwokolo E, Smart J. Food and feed legumes and oil seeds. Chapman and Hall, London, 1996, 229.
10. Praveen Kumar K, Nathish Kumar R, Muneeswari, Nagajothi T, Rajesh Lamror, Usha Kumari R. Morphological and genetic variation studies in cowpea genotypes (*Vigna unguiculata*). Legume Research. 2013; 36(4): 351-354.
11. Rhandzu PS. Effects of planting date and location on phenology yield and yield components among selected cowpea varieties. M. Sc. (Agriculture) Thesis, School of Agricultural and Environmental Science, University of Limpopo, South Africa, 2007.
12. Shivananda MC. Response of cowpea genotypes to plant density and fertilizer levels under rainfed vertisols. M. Sc. (Agriculture) Thesis, University of Agricultural Sciences, Dharwad, India, 2005.
13. Soomro NA, Khan HR. Response of mungbean genotypes to different dates of sowing in *kharif* season under rainfed conditions. Asian Journal of Plant Sciences. 2003; 2(4):377-379.