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Effect on yield of pigeonpea due to intercropping of soybean and chickpea

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Abstract
A inclined plate planter was modified for intercropping of soybean and pigeonpea in 5:2 in *Kharif* and should maintain desired spacing for sowing of chickpea on same bed in *Rabi* after harvesting soybean. Seed yield of pigeonpea was maximum at 25 cm bed height with 13.56 q/ha followed by 15 cm bed height and flat bed with 13.1 q/ha and 12.27 q/ha respectively at 120 row spacing with 40 number of gear teeth in intercrop planter. Whereas Maximum yield of soybean and chickpea was observed at 25 cm bed height i.e. 10.7 q/ha and 8.24 q/ha rescpectively. It was resulted that yield of soybean was affected by different bed height. From the study it was concluded that the yield was affected due to plant to plant spacing and bed height.

Keywords: intercropping, spacing, bed height, plant population, yield

Introduction
Intercropping is the practice of growing two or more crops together in a single field it is very productive and remunerative system to get higher crop production with proper land utilization. The main purpose of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop efficiently. Legume intercropping systems play a significant role in the efficient utilization of resources. Cereal-legume intercropping is a more productive and profitable cropping system in comparison with solitary cropping (Evans *et al.*, 2001) [1]. The main subject of intercropping is to augment total productivity per unit area and time, besides judicious and equitable utilization of land resources and farming inputs including labours (Marer *et al.*, 2007) [2].

The basic physiological and morphological differences between non-legume and legume benefit their mutual association (Akunda, 2001) [3]. The differences in the depth of rooting, lateral root spread and root densities are some of the factors of competition between the component crops in an intercropping system for water and nutrients, and hence input use efficiency. Growing legumes and cereals together for food is not only popular among subsistence farmers in the tropics, who produce the bulk of food in developing countries, but it is also expanding to the warmer regions in the tropics (Fujita and Ofosu-Budu, 1996) [4].

Intercropping has been an important practice in both developed and developing countries. It has biological, environmental and economic influences. Farmers have generally regarded intercropping as a technique that reduces risks in crop production, if one crop of an intercrop fails, the other may survive and compensate in yield to some extent, allowing the farmer an acceptable harvest. Generally, intercropping increased plant diversity, lowered pest populations and hampered pest movement. Some intercropping systems can improve soil fertility, such as intercropping legumes that fix nitrogen. Richards (1983) [5] summarized intercropping that minimized soil erosion (especially if fast growing and slower-maturing varieties are planted together), minimized spread of pests and diseases, maximized use of available soil moisture, sunlight and plant, suppression of weeds and minimized risks of crop failure. Intercropping might positively impact on the future food problems in developing countries.

In India, Soybean is grown in an area of 10.84 million hectare with an annual production of about 14.68 million tonnes and productivity of 1354 kg/ha. In Chhattisgarh Soybean occupies 121.42 thousand ha area with a yield of 1050 kg ha-1 (Anonymous, 2016) [6]. In Chhattisgarh, maximum area and production of soybean comes under Rajnandgaon followed by Kabirdham, Durg, Bemetara, Mungeli and Rajnandgaon districts.

In the present scenario, the main challenge to farmers is to increase the yield by using minimum inputs and selecting a compatible crop for mix cropping with new tool of transplanting combine with intercropping system through pigeonpea based cropping system.

India accounts for 90 per cent of world's pigeonpea growing area and 85 per cent of world's production. It is grown an area of 3.88 M ha with the production of 3.17 MT and productivity of 849 kg ha^{-1}. In Chhattisgarh it occupied an area of 134.43 thousands ha with production of pigeonpea 90.06 thousands tones and productivity of 670 kg ha^{-1} (Anonymous, 2014) [7].

Chana doesn't need much rainfall so it is mostly grown in drier areas. But it too requires sufficient water at different stages of its growth phase. Chana grows well in sandy, loamy soils which have an appropriate drainage system as water logging is detrimental to the crop. It needs relatively cooler climatic conditions as excessive heat will affect the pod development and pod maturation badly. Chickpea or Chana is one of the most important pulse crop cultivated throughout the world. India is the largest producer and consumer of Chana in the world. There are two major varieties of Chana – Desi and Kabuli. Around 80% of the Chana produced worldwide is of Desi type and the rest is of Kabuli variety. In India also Desi variety is the most commonly cultivated one Shah and Murali (2016) [8]. Chick pea ranks first in area cultivated in India, grown over an area of 8.25 million hectares with production of 7.34 million tonnes with average productivity of 889 kg ha^{-1} (In during (Anonymous, 2016) [7]. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over 95 per cent area. Chhattisgarh state has good agro-ecological situation for chickpea production. It is grown over an area of 0.2 Million hectares with an annual production of 242.7 thousand tonnes and an average productivity of 1035 kg ha^{-1} during (Anonymous, 2016) [6]. It leaves substantial amount of residual nitrogen for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility. The most important factors affecting chickpea productivity are temperature and photoperiod. Chickpea is normally sown during second fortnight of October to first fortnight of November in Chhattisgarh.

Pulse productivity is significantly affected by poor emergence, lack of uniformity and difficulty in achieving target population and weed infestation. Commercial sowing equipments such as seed drill and seed-cum-fertilizer drill operated by animal, power tiller and tractor, meter high and non-uniform seed rate causing thinning as an extra operation Singh *et al*. (2012) [9].

Mechanization in pulses helps timely completion of field operations, adds to the efficiency of the farmers in performing field operations and economizes cost of cultivation

Dubey *et al.* (2011) [10] revealed that there was increasing trends in the productivity and profitability of pulses due to various technological interventions. Use of animal or tractor drawn seed drill for pulses has enabled farmers to cover large areas in a short period very economically. However, the seed rate in sowing with the seed drill is quite high and thinning becomes essential to maintain the optimum plant stand and to ensure each plant get the desired quantity of sunlight, water and nutrients. This could be achieved by planting of different sizes of seeds with the help of appropriate planters (Kepner *et al.* 1987) [11]. It has been reported that planters provide desired plant population with uniform plant spacing and depth of operation, which results in uniform crop stand and hence, reduced cost of cultivation is achieved due to elimination of thinning operation as well as savings of seed and fertilizer (Pandey 2009) [12].

Multiple challenges associated with plough based conventional production practices that include deteriorating natural resources, declining factor productivity, shortages of water & labor and escalating costs of production inputs coupled with challenges of climate change both in irrigated intensive systems as well as low intensity rainfed ecologies are the major threat to food security of South Asia (Jat *et al.*, 2009) [13]. Water and labor scarcity and timeliness of farming operations specially planting under the emerging uncertainties are becoming major concerns of farming all across farmer typology, production systems and ecologies in the region.

Materials and Methods

The research work was experimented in IGKV Raipur 2018 to check the effect of yield on pigeonpea due to soybean and chickpea. The pigeonpea was intercropped with soybean 2:5 row and after harvesting of soybean in between pigeonpea chickpea was sown. The intercropping system was sown with inclined plate planter whereas pigeonpea was sown on defferent gear teeth 30,35 and 40 and different bed height of flat bed, upto 15 cm and upto 25 cm to check the effect of soybean and chickpea.

Experiment Details

The experiment was laid out in Split plot design for pigeonpea in which 3 main plot (different spacing) and 3 sub plot (different gear teeth) for each main plot. Resulting 9 different treatments with 3 replication.

The experiment was also laid out in RBD for comparison of different crop according to different bed height. The layout of experimental plot shown in Fig.3.30. The same layout of experimental plot was also used for different bed height. For the research experiment following data are taken:

Plant protection

There was Turga super was used for insecticide for soybean only once while celcron was used to prevent insect for pigeon pea. There was incidence of *helicoverpa sp*. and to control it profenofos 40 EC + cypermethin 4% EC insecticides @ 440-660 gm/ha was sprayed using 13 sprayers of water only once.

Nipping of chickpea

Top 3-4 leaves from each vigorous branched were removed at 32 DAS. Removal of top 3-4 leaves of branches of chickpea is called nipping. It is an age old practice adopted by farmers. Nipping in chickpea is one of the important practices for the enhancement of yield and yield contributing parameters. Foliage nipping at early stages of crop could increase number of branches while restricting profuse vegetative growth thereby promoting crop yield.

Pre-Harvest Observations

Plant population

The plant population in each plot was counted in five randomly selected of each plot and then plants were counted in intercropped area of 3.9, 4.2 and 4.5 m^2 after sowing and average population was worked out for one square meter area by considering row spacing.

Plant height (cm)

Height of five tagged plants in each plot was recorded in cm at an interval of 30, 60, 90 DAS and at harvest and then average was worked out and used for statistical analysis. Plant height was measured in cm from ground surface to uppermost leaf top.

Total number of branches/plant
Total number of branches/plant were counted from five tagged plants of each plot at 30, 60, 90 DAS and at harvest. The mean total number of branches/plant was obtained by dividing the summation with five.

Post-Harvest Studies
Number of pods/plant
Total number of pods was recorded from five randomly tagged plants in each plot and mean was worked out by dividing the total number of pods by five and used for statistical analysis.

Number of seeds/pod
Randomly selected 20 matured pods of five tagged plants from each plot were picked up and their seeds were counted and it was averaged by dividing twenty to get mean number of seeds/pod.

100-seed weight (g)
Randomly selected seed samples were taken from each net plot of soybean, pigeon pea and chickpea. Hundred healthy seeds of each plot were counted and their weight was recorded in gram accurately by using an electronic digital balance.

Grain yield per plant
Grains obtained from each crop from sampled plants were weighted on pan balance in g/plant and average grain yield/plant was calculated.

Grain yield (kg/ha)
Seed yield of soybean, pigeon pea and chickpea of the each net plot net area of was noted down, after threshing, winnowing and drying and was converted into (kg/ha).

Stover yield (kg/ha)
Straw yield of Seed yield of soybean, pigeon pea and chickpea was obtained by subtracting seed yield (kg/ha) from biological yield (kg/ha).

Harvest index
It was calculated by dividing the grain yield (economic yield) by the total dry matter (Biological yield) and multiplied by 100 (Donald, 1962).

$$\text{Harvest index \%} = \frac{\text{Grain yield (q/ha)}}{\text{Total Biological yield (q/ha)}} \times 100 \ldots\ldots\ldots (1)$$

Pigeon pea equivalent yield with soybean
The Pigeon pea grain yield equivalent was calculated with the help of following formula

$$\text{Pigeonpea equivalent yield}\left(\frac{q}{ha}\right)\text{with soybean} = \frac{\text{Pigeonpea grain yield}\left(\frac{q}{ha}\right) \cdot \text{soybean grain yield}\left(\frac{q}{ha}\right) \text{ x rate of pigeonpea} + \text{x rate of soybean}}{\text{rate of pigeonpea}} \ldots\ldots\ldots (2)$$

Pigeon pea equivalent seed with chickpea
Soybean yield equivalent was calculated as described by following formula (Prasad and Srivastava 1991).

$$\text{Pigeonpea equivalent yield}\left(\frac{q}{ha}\right)\text{with chickpea} = \frac{\text{Pigeonpea grain yield}\left(\frac{q}{ha}\right) \cdot \text{chickpea grain yield}\left(\frac{q}{ha}\right) \text{ x rate of pigeonpea} + \text{x rate of chickpea}}{\text{rate of pigeonpea}} \ldots\ldots\ldots (3)$$

Note -Rate of Soybean =3050 Rs/q, pigeon pea =5450 Rs/q, and chickpea =4400 Rs/q MSP rate were taken for study.

Land Equivalent Ratio (LER)
The Land Equivalency Ratio (LER) is method for assessing intercrop performance compared to pure stand yields. To calculate a LER, the intercrop yields were divided by the pure stand yields for each component crop in the intercrop. Then, these values were added together. Pigeon pea crop was taken as pure and LER calculated with following formula

$$\text{LER with soybean} = \frac{\text{yield of pigeonpea in intercrop q/ha}}{\text{yield of pigeonpea in sole crop q/ha}} + \frac{\text{yield of soybean in intercrop q/ha}}{\text{yield of soybean in sole crop q/ha}} \ldots\ldots (4)$$

$$\text{LER with chickpea} = \frac{\text{yield of pigeonpea in intercrop q/ha}}{\text{yield of pigeonpea in sole crop q/ha}} + \frac{\text{yield of chickpea in intercrop q/ha}}{\text{yield of chicknpea in sole crop q/ha}} \ldots (5)$$

When an LER measures 1.0, it shows that the amount of crop grown together is the same as that for crop grown in the pure stand, it means there was no advantage to intercropping over pure stands. LER >1.0 show an advantage for intercropping, while values <1.0 show a disadvantage for intercropping.

Result and Discussion
Growth studies of pigeonpea on different number of gear teeth and row spacing
Plant population
The observation of plant population per m^2 of pigeonpea was recorded at 20 DAS and at harvest are presented in Table 1. The plant population of pigeonpea was recorded according to combinations of row spacing (60, 90 and 120) with different gear teeth (30, 35 and 40) at harvest and its mean value varies from 8.45 to 15.5 plants/m^2. The results revealed that there was non-significant variation in main plot of plant population at 20 DAS and at harvest due to row spacing but significant variation observed at sub plot due to different gear teeth shown in Table 4.27 and Table 4.28. At 40 gear teeth minimum plant population per meter row length was observed because of plant to plant was more than the 30 and 35 gear teeth. It was observed that increasing gear teeth plant to plant

distance also increased. The interaction effect was observed that the main plot does not affect the subplot.

Table 1: Plant population per m^2 at 20 DAS and at harvest of pigeonpea

Main Plot	Sub Plot	20 DAS	Harvest
M1(60 cm spacing)	S1(30 teeth)	15.5	12.4
	S2(35 teeth)	13.2	11.22
	S3(40 teeth)	10.6	8.79
M2(90 cm spacing)	S1(30 teeth)	15.03	12.02
	S2(35 teeth)	12.54	10.65
	S3(40 teeth)	10.17	8.44
M3(120 cm spacing)	S1(30 teeth)	15.19	12.15
	S2(35 teeth)	13.86	11.78
	S3(40 teeth)	11.44	9.50
CD	Main Plot	0.49	0.21
	Sub Plot	NS	NS
CV	Main Plot	11.86	6.22
	Sub Plot	6.89	4.49

Plant height (cm)

The data pertaining to plant height of pigeonpea at 30, 60 and at harvest stage of soybean are given in Table 2. The plant height of pigeonpea was recorded according to combinations of row spacing (60, 90 and 120) with different gear teeth (30, 35 and 40) at 20 DAS and at harvest. The plant height was observed that varies 41.42 cm to 45.47 cm at 30 DAS, 95.9 cm to 101.5 cm at 60 DAS and 209 cm to 221 cm at harvest. The plant height of pigeonpea was found to be maximum in 60 cm row spacing at different gear teeth because of more plant population. The data revealed that there was no significant effect of row spacing of crop on plant height but significant effect of different gear teeth.

Table 2: Plant height of pigeonpea at 30 DAS, 60 DAS and at harvest

Main plot	Sub plot	30 DAS	60 DAS	Harvest
M1(60 cm spacing)	S1(30 teeth)	45.475	101.5	217
	S2(35 teeth)	42.218	100.2	220
	S3(40 teeth)	45.344	98.4	221
M2(90 cm spacing)	S1(30 teeth)	44.625	100	218
	S2(35 teeth)	43.472	99.1	216
	S3(40 teeth)	41.42	101.5	217
M3(120 cm spacing)	S1(30 teeth)	42.5	99.6	210
	S2(35 teeth)	41.8	95.9	213
	S3(40 teeth)	43.6	96.8	209
CD	Main plot	0.84	3.28	4.24
	Sub plot	NS	NS	NS
CV	Main plot	3.97	4.76	4.09
	Sub plot	6.07	10.3	6.13

Number of branches per plant

The number of branches of pigeonpea was recorded at 30 DAS, 60 DAS and at harvest and is given in Table 3. The number of branches per plant of pigeonpea was recorded according to combinations of row spacing (60, 90 and 120) with different gear teeth (30, 35 and 40) at 30 DAS, 60 DAS and at harvest. The number of branches/plant was observed that it varies 4.75 to 5.83 at 30 DAS, 7.07 to 8.91 at 60 DAS and 10.53 to 12.54 at harvest. The data revealed that there was significant effect in number of branches per plant due to row spacing and different gear teeth. From the result it was observed that row spacing affect the branches as it increases number of branches also increases. It may be due to the wider spacing between soybean and pigeonpea which cause plants having the favorable condition for growth.

Table 3: Number of branches per plant of pigeonpea

Main plot	Sub plot	30 DAS	60 DAS	Harvest
M1(60 cm spacing)	S1(30 teeth)	4.75	7.07	10.53
	S2(35 teeth)	4.89	7.84	10.8
	S3(40 teeth)	5.12	8.05	11.67
M2(90 cm spacing)	S1(30 teeth)	5.07	7.24	10.88
	S2(35 teeth)	5.23	8.15	11.56
	S3(40 teeth)	5.6	8.65	12.18
M3(120 cm spacing)	S1(30 teeth)	5.42	7.82	11.83
	S2(35 teeth)	5.56	8.79	11.87
	S3(40 teeth)	5.83	8.91	12.54
CD	Main plot	0.05	0.08	0.12
	Sub plot	0.10	0.16	0.23
CV	Main plot	6.20	6.25	6.17
	Sub plot	4.07	4.18	4.06

Yield attributes

Number of pods per plant

The number of pods/plant of pigeonpea was recorded according to combinations of row spacing (60, 90 and 120) with different gear teeth (30, 35 and 40) and it varies from 170.91 to 222.87. The maximum number of pod was 222.87 in the combination of 120 row spacing with 40 number of gear teeth due to wide spacing between pigeonpea which received the soil aeration, high nutrients for optimum plant growth for higher number of pod/plant than The data revealed that there was significant effect in number of pods/plant due to row spacing and different gear teeth. The statistical analysis of number of pods/plant of pigeonpea has been given in Table 4.

Number of seeds per pod

The number of seeds/pod of pigeonpea was recorded according to combinations of row spacing (60, 90 and 120) with different gear teeth (30, 35 and 40) and it varies from 1.98 to 3.08.The maximum number of seed/pod was 3.08 in the combination of (M3) 120 row spacing with 40 number of gear teeth due to plant growth characteristics. Number of seed per pod was found lowest in M1S1, M1S2, and M1S3, cropping system due to high density and less spacing of plant. The data revealed that there was significant effect in number of seeds/pod due to row spacing and different gear teeth. The observed data and statistical analysis of number of seeds/pod of pigeonpea has been given in Table 4.

Table 4: Number of pods and seed per pod of pigeonpea at different gear and spacing

Main plot	Sub plot	No of pod	Seed per pod
M1(60 cm spacing)	S1(30 teeth)	170.91	1.98
	S2(35 teeth)	176.9	2.38
	S3(40 teeth)	185.36	2.53
M2(90 cm spacing)	S1(30 teeth)	190.65	2.22
	S2(35 teeth)	195.8	2.76
	S3(40 teeth)	202	2.9
M3(120 cm spacing)	S1(30 teeth)	208.36	2.47
	S2(35 teeth)	213.42	3.02
	S3(40 teeth)	222.87	3.08
CD	Main plot	2.01	0.02
	Sub plot	3.92	0.05
CV	Main plot	6.22	6.34
	Sub plot	4.05	4.22

Seed yield is the most important character and superiority of the treatment is judged by its capacity to produce more seed yield. It was found that highest yield was 12.27 q/ha in the combination of 120 row spacing with 40 number of gear teeth (M3S3). It was also observed that in the combination of all row spacing and 40 number of gear teeth higher yield was obtained as compared to 30 and 35 number of gear teeth. The data revealed that there was significant effect in seed yield due to row spacing and different gear teeth.

Stover yield

Among the different treatment, highest stover yield was found 34.59 in 120 row spacing with 40 number of gear teeth of pigeonpea (M3S3). The data revealed that there was significant effect in stover yield due to row spacing and different gear teeth. Stover yield of different treatment is given in Table 5.

Harvest Index

The highest harvest Index was 26.43% in 120 row spacing with 30 number of gear teeth (M3S1). The data revealed that there was significant effect in harvest Index due to row spacing and different gear teeth. Data recorded on harvest Index are presented in Table 5. There was higher significance difference was found at sub plots with coefficient of variation 6.19 %.

Table 5: Seed yield, stover yield and harvest Index of pigeonpea at sole crop and different intercropping system

Main plot	Sub plot	Yield	Stover	Harvest Index
M1(60 cm spacing)	S1(30 teeth)	9.424	30.32	23.71
	S2(35 teeth)	9.568	31.21	23.46
	S3(40 teeth)	9.816	32.11	23.41
M2(90 cm spacing)	S1(30 teeth)	10.83	31.87	25.37
	S2(35 teeth)	10.16	32.59	23.77
	S3(40 teeth)	11.04	33.01	25.06
M3(120 cm spacing)	S1(30 teeth)	11.78	32.78	26.43
	S2(35 teeth)	11.96	33.9	26.07
	S3(40 teeth)	12.27	34.59	26.18
CD	Main plot	0.11	0.33	0.25
	Sub plot	0.21	0.64	0.49
CV	Main plot	6.26	6.17	6.19
	Sub plot	4.07	4.07	4.09

Table 6: Plant population per m^2 of pigeonpea at different bed height

Treatment	Plant population per m^2	
	20 DAS	At harvest
Flat (0 cm)	11.45	9.50
Medium (15 cm)	11.89	10.1
High (25 cm)	12.13	10.87
SEm±	0.37	0.25
CD	1.16	0.79
CV	7.64	6.06

Growth and yield studies of pigeonpea on different bed height

Plant population

The data pertaining to plant population per $m^2$of pigeonpea at 20 DAS and at harvest have given in Table 6. After observing the data it was evident that the 20 DAS plant population was higher in 25 cm bed height. At harvest stage of pigeonpea reduction in plant population were observed due to mortality. It was observed that the bed height affect the plant population due to accumulation of moisture effect. It was found to be that plant damage was more in flat bed condition followed by 15 cm bed height and 25 cm bed height.

Plant height (cm)

Plant height of pigeonpea at 30 DAS and at harvest has been given in Table 7. After observing the data it was evident that the 30 DAS plant height was higher in 25 cm bed height. At harvest stage of pigeonpea reduction in Plant height were observed due to mortality. From the result it was observed that bed height affect the Plant height for proper germination and plant damage due to moisture effect. Plant height was observed non-significant at 5% level of significance in different bed height. At harvest the plant height was observed 210.97 cm at 25 cm bed height followed by 210.32 cm and 209.13 at 15 cm bed height and flatbed respectively.

Table 7: Plant height of pigeonpea at different bed height

Treatment	Plant height, cm	
	30 DAS	At harvest
Flat (0 cm)	43.6	209.13
Medium (15 cm)	44.3	210.32
High (25 cm)	44.76	210.97
SEm±	1.07	0.87
CD	3.36	2.73
CV	5.91	5.99

Table 8: Number of branches of pigeonpea at different bed height

Treatment	Number of branches	
	30 DAS	**90 DAS**
Flat (0 cm)	5.83	12.54
Medium (15 cm)	6.23	13.24
High (25 cm)	6.98	13.72
SEm±	0.15	0.32
CD	0.49	1.01
CV	6.06	5.94

Number of branches per plant
Number of branches of pigeonpea at 30 DAS and 90 DAS has been given in Table 8. It was revealed that bed height affect the branches of pigeonpea. Upto 25 cm bed height produced maximum number of branches as compared to the 15 cm bed height and flat bed. 8.

Seed yield
Yield of chickpea has been given in Table 4.79. From the result it was observed that yield of chickpea was also affected by different bed height. Maximum Yield was observed in 25 cm bed height i.e. 8.24 q/ha. Yield of chickpea was observed non-significant at 5% level of significance it means that there was no difference in yield was observed at different bed height shown in Table 9.

Stover yield
Stover yield of chickpea has been given in Table 4.79. From the result it was observed that stover yield of chickpea was also affected by different bed height. Maximum stover yield was observed in 25 cm bed height i.e. 14.97 q/ha. Stover yield of chickpea was observed non-significant at 5% level of significance it means that there was no different stover yield was observed at different bed height shown in Table 9.

Harvest Index
Harvest Index of chickpea has been given in Table 4.79. From the result it was observed that harvest Index of chickpea was also affected by different bed height. Maximum harvest Index was observed in 25 cm bed height i.e. 35.52%. Harvest Index of chickpea was observed non-significant at 5% level of significance it means that there was no different harvest Index was observed at different bed height shown in Table 9.

Table 9: Seed yield, stover yield and harvest Index of chickpea at different bed height

Treatment	Yield (q/ha)	Straw (q /ha)	Harvest Index (%)
Flat (0 cm)	7.88	14.3	35.52
Medium (15 cm)	8.05	14.77	35.27
High (25 cm)	8.24	14.97	35.50
SEm±	0.204	0.467	0.867
CD	0.642	1.473	2.732
CV	6.193	7.790	5.994

Conclusion
- Soybean, pigeonpea and chickpea intercropping system shows the most parallel intercropping practice for higher benefit. The intercrop planter was found most suitable for obtaining desired spacing with soybean and pigeonpea and permits a second crop of chickpea which was not feasible in traditional practice.
- The intercropping practice of 120 cm row spacing and upto 25 cm bed height was most suitable for getting maximum LER more than 1.Sole cropping system of pigeonpea was not suitable for yield and cost benefit. 120 cm row spacing of pigeonpea was most suitable as well 30 cm plant to plant spacing which give the maximum yield because of plants get the proper aeration, soil nutrients and favorable condition for proper plant growth. It was also concluded that in 120 cm row spacing that it does not affect the intercrop soybean and chickpea much as compared to other treatments.

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