



Influence of Land Configurations on Growth, Yield and Profitability of Mustard and Chickpea Intercropping Systems under Organic Management in Bundelkhand

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Abstract: Field experiment was conducted involving eight treatments during *Rabi* season 2018-19 at Bundelkhand University Campus, Jhansi India. The various metrics were significantly higher in the different inter-cropping systems of mustard + chickpea among row ratios. The plant height of the mustard increased up to 199.9 cm in the 2:1 ratio of mustard (SLB) + chickpea (R). Highest plant fresh 240.3 g and dry weights 58.7 g were achieved in the 1:1 ratio of mustard (F) + chickpea (R). The linked crops mustard (LB) + chickpea (UB) in a 2:2 ratio produced 725 capsules, 16.37 seeds per capsule, and 6.98 g of weight per 1000 seeds, respectively. On individual crop basis highest seed yield of mustard (31.41 q ha⁻¹) and chickpea (20.21 q ha⁻¹) was obtained when crops were sown alone on FB mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under Broad bed and furrow system gave highest mustard equivalent yield, chickpea equivalent yield, land equivalent ratio, gross returns (ha⁻¹), net returns (ha⁻¹), benefit cost ratio and profitability. In terms of land equivalent ratio (1.50), intercropping mustard (F) and chickpea (BB) in a ratio of 1:3 was more productive than seeding chickpea and mustard in solo stands.

Keywords: Mustard, Chickpea, intercropping, Land configurations, Organic management

Mustard and chickpea are raised as sole crops as well as intercropping system under organic management. Intercropping is the production of growing two or more crops simultaneously in the same piece of land at the same time. Intercropping is a simple but inexpensive strategy and has been recognized as a potentially benefited technology for increasing crop production. It can ensure substantial yield advantages as compared to sole cropping (Gangwar et al 2018). The main advantage of intercropping is the more efficient utilization of the available resources and the increased productivity compared with each sole crop of the mixture (Launayet et al 2009). Intercropping is one of the best agronomical options to minimize risk and will be act as insurance against main crop failure in the vast rainfed tracts in the country (Sankaranarayanan et al 2010). The selection of compatible crops is one of important consideration in deciding an economically viable and feasible intercropping system. Mustard + chickpea is a prominent intercropping system in Indian sub-continent. The majority of the farmers adopt this system under resource constraint conditions (Kour and Sharma 2016). Land management system plays a major role in minimizing soil erosion and improving water use efficiency of field crops. Easy and uniform germination as well as growth and development of plant are provided by manipulation of sowing method. Land configuration increases water use efficiency as reported by (Deshmukh et

al 2016). Land configuration methods including the alteration of shape of seed bed and land surface among the various methods the broad bed and furrow sowing, Furrow sowing, ridge sowing, ridge with mulches and alternate furrow sowing are adopted by the crop growers for mustard and other crops for obtaining the better yield over the flat bed or conventional method of sowing. Better conditions for plant growth are provided in furrow planting due to higher soil moisture, higher salt leaching and reduction in evaporation from the soil surface (Singh et al 2017). Modified land configuration, such as furrow irrigated raised bed (FIRB) has shown good promise in enhancing chickpea performance (Jat et al 2005, Ahlawat et al 2010). Therefore, present study was undertaken with the view to find out the influence of sowing methods using land configurations on growth, yield and profitability of mustard and chickpea intercropping system under organic management.

MATERIAL AND METHODS

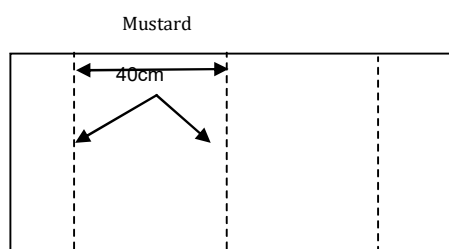
The field experiment was conducted at Bundelkhand University, Jhansi during winter Season 2018-19, under Bundelkhand Agro climatic Zone (6) of Uttar Pradesh and is situated at 25.44° N and 78.56° E longitude at a height of 258 meters above sea level during *Rabi* season 2018-19. The soil of experimental field was sandy loam texture. The experiment was laid out in randomized block design with three replication

having unit plot size of 5.67 m² (2.7×2.1 m) comprising of eight treatments of mustard and chickpea in different row combinations i.e. alone, 1:1, 2:2, 2:1, 1:2 and 1:3 and six land configurations as sowing methods i.e. flat bed, pair row, shallow lower bed and ridge, broad bed and furrow, narrow bed and furrow, furrow irrigated ridge bed system under organic management. The sketch of land configurations as used in the sowing methods is depicted in Figure 1. Soil samples from each treatment were collected and analyzed for soil nutrient analysis. Agronomic advantages, competition functions and monetary indices were calculated.

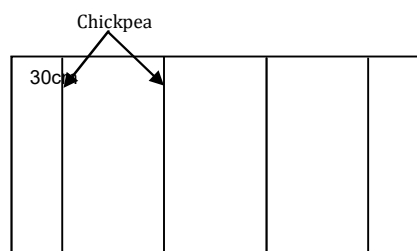
Organic carbon was estimated using Walkley and Black's Method while available nitrogen was estimated using alkaline potassium permanganate Method (Subbiah and Asija, 1956), available phosphorus by Olsen's method and available potassium by flame photometer (Table 1). The data was statistically analyzed through M-STAT software.

Mustard equivalent yield: Yield of individual crop was converted into equivalent yield (q ha⁻¹) on the basis of prevailing market price of the crop as per Katyal and Gangwar (2011). Mustard equivalent yield (MEY) was calculated by the following formula:

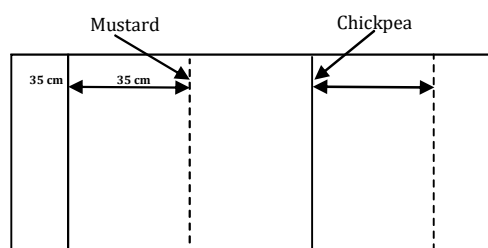
T₁ Mustard alone (FB) - 40 x 15 cm



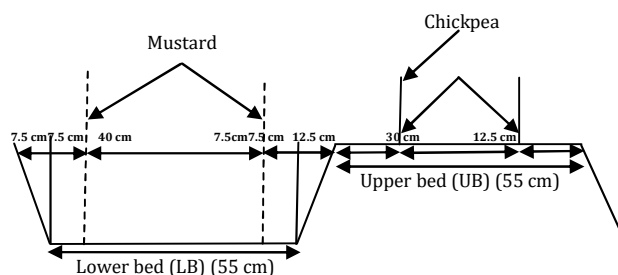
T₂ Chickpea alone (FB) - 30 x 10 cm



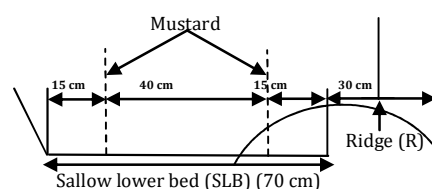
T₃ Mustard + Chickpea alone (1:1) - Flat bed



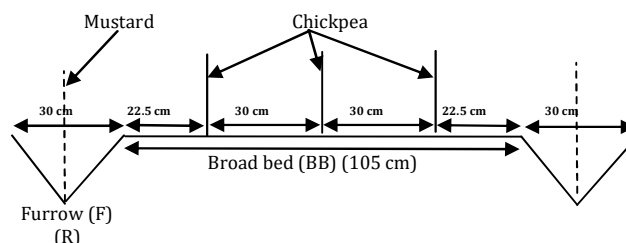
T₄ Mustard (LB) + Chickpea (UB) (2:2) PRS



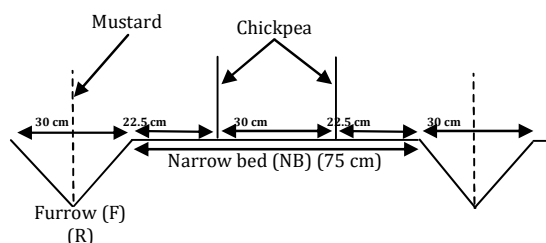
T₅ Mustard (SLB) + Chickpea (R) (2:1) SLBR



T₆ Mustard (F) + Chickpea (BB) (1:3) BBF



T₇ Mustard (F) + Chickpea (NB) (1:2) NBF



T₈ Mustard (F) + Chickpea (R) (1:1) FIRB

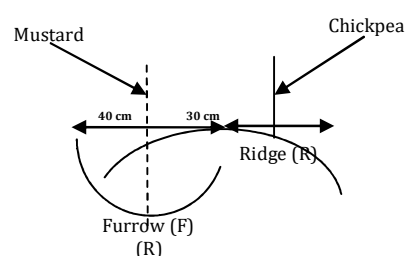


Fig. 1. Land configurations used as sowing methods

$$MEY = \frac{\text{Grain Yield of chickpea} \times \text{Price of chickpea}}{\text{Price of mustard}}$$

$$CEY = \frac{\text{Grain Yield of mustard} \times \text{Price of mustard}}{\text{Price of chickpea}}$$

Land equivalent ratio: The relative advantage of intercropping compared to sole cropping was calculated for each proportion using total LER. LER was calculated as the sum of the ratios of yield of each component crop in intercropping systems to its corresponding yield under sole crop (Rao and Willey 1980). Land equivalent ratio (LER) was calculated:

$$LER = \frac{Y_{ab}}{Y_{aa}} + \frac{Y_{ba}}{Y_{bb}}$$

Where Y_{aa} and Y_{bb} are the sole crop yields of crops a and b, respectively, Y_{ab} is the intercrop yield of crop a, and Y_{ba} is the intercrop yield of crop b. In this calculation crop a is mustard and crop b is chickpea.

Aggressivity: Aggressivity was calculated by the formula proposed by Gilchrist (1965).

$$A_{ab} = \frac{Y_{ab}}{Y_{aa} \times Z_{ab}} - \frac{Y_{ba}}{Y_{bb} \times Z_{ba}}$$

Where A_{ab} aggressivity for the component crop 'a' Y_{aa} and Y_{bb} are the pure stand crop of crops a and b, respectively, Y_{ab} intercrop yield of crop 'a' and Y_{ba} intercrop of crop 'b', in this equation a is denoted for mustard and b for chickpea.

Economics: The cost of cultivation was worked out by taking all the expenses incurred into consideration. Gross income was worked out by multiplying grain and straw yield of the crop with their prevailing market prices. The cost of field preparation, manures, seed and sowing, plant protection etc. was also calculated based on prevailing market prices. Net returns (INR ha⁻¹), B: C and Profitability (INR day⁻¹) was calculated with the help of standard formulas which are as follows.

$$\text{Gross return} = \text{Crop yield (q/ha)} \times \text{Price of crop (Rs/q)}$$

$$\text{Net return} = \text{Gross return} - \text{Total cost of cultivation}$$

$$BCR = \frac{\text{Net return (Rs/ha)}}{\text{Cost of cultivation (Rs/ha)}} \quad \text{Profitability} = \frac{\text{Net return (Rs/ha)}}{\text{Duration of crops (in days)}}$$

RESULTS AND DISCUSSION

Effect of Chickpea Intercropping

Growth attributes of mustard: The growth attributes of mustard were significantly influenced in intercropping of chickpea using different land configuration (Table 2). The maximum plant height (24.54 cm) of mustard was at 30 DAS when mustard grown in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under paired row system (PRS) of intercropping. At 60 and 90 DAS the maximum plant height was when mustard was grown in shallow lower beds (SLB) + chickpea on ridges (R) in ratio of 2:1 intercropping system as compared to the other row ratios using land configurations. Different planting pattern had significant effect on plant height and maximum plant height was attained when sown on wide beds (Malik et al 2006, Allolli et al 2008). The maximum fresh weight of plant, was recorded at 30, 60 and 90 DAS (16.50 g, 136.30 and 240.33 g respectively) when mustard grown in furrows (F) + chickpea on ridges (R) in ratio of 1:1 under FIRB system of intercropping. This was statistically at par with mustard grown in shallow lower beds (SLB) + chickpea on ridges (R) in ratio of 2:1 under SLBR system of intercropping using land configurations which was higher compared to the mustard alone on flat bed (FB) system. Ambika et al. (2019) reported that BBF system of planting recorded more haulm yield than flat-planted in urdbean. The maximum dry weight accumulation of 2.19, 30.30 and 58.67 g, per plant was at 30, 60 and 90 DAS respectively when mustard grown in furrows (F) + chickpea on ridges (R) in ratio of 1:1 under FIRB system of intercropping. However, it was statistically at par with mustard grown in shallow lower beds (SLB) + chickpea on ridges (R) in ratio of 2:1 under SLBR system of intercropping.

Table 1. Initial soil properties of experimental site

Particular	Values	Analytical method applied
Texture	Sandy loam	Deshpande et al (1971)
Sand (%)	42.0	
Silt (%)	38.0	
Clay (%)	20.0	
pH _{1:2.5}	7.4 (Neutral)	Potentiometric
Organic carbon (%)	0.48 - 0.50 (Low)	Walkley and Black's rapid titration method
Available nitrogen (kg ha ⁻¹)	212 (Low)	Alkaline KMnO ₄ method
Available phosphorus (kg ha ⁻¹)	14 (Medium)	Olsen's method
Available potassium (kg ha ⁻¹)	185 (Medium)	Flame photometric method

and mustard in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under PRS of intercropping with using land configuration which was higher compared to the mustard alone under flat bed (FB) system. Similar results were obtained by Allolli et al (2008).

Yield attributes of mustard: The maximum number of siliqua plant⁻¹ was in mustard when grown in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under PRS (725.00). However, it was statistically at par with mustard alone flat bed (FB) system, which was significantly higher as compared to all other mustard + chickpea intercropping systems and sole cropping (Table 3). The maximum number of grains capsule⁻¹ (16.37) was in mustard grown in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under (PRS). However, it was statistically at par with mustard alone flat bed (FB) system, which was significantly better as compared to all other mustard + chickpea intercropping systems and sole cropping. The maximum 1000-grain weight (6.98) was in mustard in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under PRS, which was statistically higher than all other mustard + chickpea intercropping systems and sole cropping.

Yield and yield index of mustard: The seed and stover yield of mustard was significantly higher in sole mustard (31.41 q ha⁻¹) sown in flat bed system, which was higher than all other mustard + chickpea intercropping systems. These results agree to the findings of Kumar and Singh, (2006) and Kour et al., (2014). Similarly, higher straw yield of mustard (97.94 q ha⁻¹) was obtained in mustard alone flat bed system, which was significantly higher than all the mustard + chickpea intercropping row ratios using land configurations. Significantly highest harvest index of mustard (30.98%) was when mustard grown in furrows (F) + chickpea on narrow beds (NB) in ratio of 1:2 under NBF system which was higher than all the mustard + chickpea row ratios using land configurations.

Influence of Mustard Intercropping on Chickpea

Growth attributes of chickpea: The significantly maximum plant height (14.25cm) of chickpea was recorded at 30 DAS when mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system. However, at 60 and 90 DAS of crop growth, the maximum plant height 13.52 and 35.94cm, respectively was recorded in chickpea alone under flat bed system as compared to the all-other row ratios (Table 4).

Table 2. Effect of intercropping systems using land configurations on periodic plant height, fresh and dry weight of mustard under organic management

Treatments / Intercropping system	Plant height at DAS (cm)			Plant fresh weight at DAS (g)			Plant dry weight at DAS (g)		
	30	60	90	30	60	90	30	60	90
T ₁ Mustard alone (FB)	20.4	120.7	196.3	11.2	122.2	204.7	1.01	15.90	41.00
T ₃ Mustard (FB) + Chickpea (FB) (1:1) FB	14.7	104.2	175.6	10.2	122.6	209.8	0.54	16.08	44.34
T ₄ Mustard (LB) + Chickpea (UB) (2:2) PRS	24.5	110.3	190.9	13.9	126.2	219.9	1.21	27.50	52.22
T ₅ Mustard (SLB) + Chickpea (R) (2:1) SLBR	24.0	127.3	199.9	10.6	132.8	231.2	0.53	29.55	56.00
T ₆ Mustard (F) + Chickpea (BB) (1:3) BBF	23.2	107.0	184.7	13.4	124.0	213.4	1.18	21.53	51.00
T ₇ Mustard (F) + Chickpea (NB) (1:2) NBF	15.9	116.5	194.1	9.9	103.8	195.0	0.49	14.37	40.78
T ₈ Mustard (F) + Chickpea (R) (1:1) FIRB	23.5	124.8	197.3	16.5	136.3	240.3	2.19	30.30	58.67
CD (p=0.05)	1.66	4.86	7.14	1.60	5.31	13.09	0.57	1.91	2.76

Table 3. Effect of intercropping systems using land configurations on yield attributes of mustard under the organic management

Treatments	Number of siliqua plant ⁻¹	Number of seeds siliqua ⁻¹	1000-grain weight (g)	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	HI (%)
T1	718.33	16.13	6.63	31.41	97.94	24.28
T3	590.00	13.33	5.78	26.41	62.86	29.60
T4	725.00	16.37	6.98	27.85	86.23	24.41
T5	696.00	15.12	6.53	29.28	97.48	23.09
T6	658.67	13.80	6.24	18.05	64.81	21.79
T7	602.00	13.67	5.84	23.03	51.30	30.98
T8	676.67	14.97	6.27	24.50	67.60	26.60
CD (p=0.05)	31.64	1.67	N.S.	1.81	2.46	2.13

See details of treatments in Table 2

Significantly maximum fresh weight 2.22, 12.16 and 35.89 g, of chickpea was at 30, 60 and 90 DAS respectively when mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system. It was statistically followed by mustard grown in lower beds (LB) + chickpea on ridges (R) in ratio of 2:1 under PRS and chickpea alone on flat bed (FB) system. Significantly maximum dry weight accumulation, was recorded at 30, 60 and 90 DAS respectively when mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system. It was statistically at par with mustard grown in shallow lower beds (SLB) + chickpea on ridges (R) in ratio of 2:1 under SLBR, which was significantly higher as compared to other all other treatments.

Yield attributes of chickpea: The maximum number of pods plant⁻¹ (69.44) and number of grains pod⁻¹ (1.73) were in chickpea alone and was statistically at par with mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system of intercropping but was significantly higher than all other mustard + chickpea row ratios using land configurations and sole cropping (Table 4).

Similarly, maximum 1000-grain weight (199.78) was recorded in chickpea alone under flat bed (FB) system, which was significantly at par with mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system, which was statistically higher than all other mustard + chickpea intercropping systems and sole cropping.

Yield and yield index of chickpea: The maximum grain yield (20.21 q ha⁻¹) and straw yield (47.28 q ha⁻¹) were obtained in chickpea alone under flat bed (FB) system, which was significantly higher than all other mustard + chickpea intercropping systems. Among the mustard grown in furrows (F) + chickpea broad beds (BB) in ratio of 1:3 under BBF system was obtained significantly higher grain yield (29.28 q ha⁻¹) all other row ratios using land configurations, the lowest grain yield (5.90 q ha⁻¹) was obtained in mustard grown on flat beds (FB) + chickpea on flat beds (FB) in ratio of 1:1 under flat bed system. Significantly highest harvest index of chickpea (40.63%) was observed when mustard grown in furrows (F) + chickpea on ridges (R) in ratio of 1:1 under FIRB system than all other treatments, it was statistically at par with mustard in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under PRS.

Table 4. Effect of intercropping systems using land configurations on growth parameters of chickpea under of organic management

Treatments / Intercropping system	Plant height (cm) at DAS			Plant fresh weight (g) at DAS			Plant dry weight (g) at DAS		
	30	60	90	30	60	90	30	60	90
T ₂ Chickpea alone (FB)	13.52	35.94	69.56	1.89	9.02	30.44	0.31	1.88	6.78
T ₃ Mustard (FB) + Chickpea (FB) (1:1) FB	13.36	31.11	63.44	1.61	6.7	21.66	0.23	1.76	5.44
T ₄ Mustard (LB) + Chickpea (UB) (2:2) PRS	12.67	31.47	64.00	1.36	6.42	18.00	0.15	1.38	4.33
T ₅ Mustard (SLB) + Chickpea (R) (2:1) SLBR	12.55	30.67	62.28	2.11	10.89	31.22	0.34	2.07	7.08
T ₆ Mustard (F) + Chickpea (BB) (1:3) BBF	14.25	33.67	65.22	2.22	12.16	35.89	0.37	3.20	9.76
T ₇ Mustard (F) + Chickpea (NB) (1:2) NBF	11.74	30.11	61.56	1.53	6.65	19.89	0.20	1.46	4.71
T ₈ Mustard (F) + Chickpea (R) (1:1) FIRB	11.84	29.22	57.11	1.5	7.89	29.11	0.17	1.80	5.73
CD (p=0.05)	0.74	2.82	4.21	0.59	1.38	1.67	0.01	0.83	1.19

Table 5. Effect of intercropping systems using land configurations on yield attributes of chickpea under the organic management

Treatments	Number of pods plant ⁻¹	Number of seeds pod ⁻¹	1000-grain weight (g)	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	HI (%)
T2	69.44	1.73	199.78	20.21	47.28	29.93
T3	37.78	1.37	179.45	5.90	12.13	32.94
T4	43.56	1.40	185.78	8.50	13.09	39.41
T5	45.89	1.47	187.92	6.04	11.72	34.02
T6	54.78	1.67	194.98	18.73	37.61	33.17
T7	53.89	1.63	192.66	12.73	19.66	39.28
T8	53.11	1.50	189.53	10.46	15.31	40.63
CD (p=0.05)	1.25	N.S.	1.79	1.47	2.29	5.60

See details of treatments in Table 4

Agronomic Benefits and Competition Functions of Intercropping

Mustard equivalent yield: The highest mustard equivalent yield (38.66 q ha^{-1}) was recorded when mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system of intercropping, which was statistically at par with mustard grown in lower beds (LB) + chickpea on upper beds (UB) in ratio of 2:2 under PRS. It was significantly higher than all other mustard + chickpea intercropping systems and sole cropping (Table 6).

Land equivalent ratio: Mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF of intercropping recorded maximum land equivalent ratio of 1.50, which was statistically at par with mustard grown in furrows (F) + chickpea (NB) (1:2) NBF system and Mustard grown in furrows (F) + chickpea on ridges (R) in ratio of 1:1 under FIRB system of intercropping (1.36 and 1.31) respectively while it was significantly higher than all other mustard + chickpea intercropping systems and sole

cropping. Similar results reported Singh et al (2019).

Aggressivity: In all the treatments mustard dominated the chickpea in mustard + chickpea intercropping systems. The highest positive aggressivity (0.55) in mustard was in mustard grown on flat beds (FB) + chickpea on flat beds (FB) in ratio of 1:1 under flat bed system of intercropping using land configurations.

Competitive ratio (CR): The highest competitive ratio (CR) of 2.88 in mustard was in mustard + chickpea grown in ratio of 1:1 under flat bed (FB) system. In all the mustard + chickpea intercropping systems, the CR values more than unity indicating its superior ability of competition to chickpea. The lowest difference (0.85) between CR value of mustard (1.51) and chickpea (0.66) was in mustard grown in furrows (F) + chickpea on ridges (R) in ratio of 1:1 under FIRB system row ratio using land configurations.

Economics of intercropping: The highest cost of cultivation ($\text{Rs } 33,100 \text{ ha}^{-1}$) was incurred in chickpea alone grown on flat beds (FB) under flat bed system, which was

Table 6. Effect of intercropping systems using land configurations on yield attributes of chickpea under the organic management

Intercropping system	MEY (q ha ⁻¹)	CEY (q ha ⁻¹)	LER	Aggressivity		Competitive ratio	
				Mustard	Chickpea	Mustard	Chickpea
Mustard alone (FB)	31.41	28.55	1.00	-	-	-	-
Chickpea alone (FB)	22.23	20.21	1.00	-	-	-	-
Mustard (FB) + Chickpea (FB) (1:1) FB	32.89	29.90	1.13	0.55	-0.55	2.88	0.35
Mustard (LB) + Chickpea (UB) (2:2) PRS	37.20	33.82	1.31	0.23	-0.23	2.11	0.48
Mustard (SLB) + Chickpea (R) (2:1) SLBR	35.92	32.66	1.23	0.17	-0.17	1.56	0.64
Mustard (F) + Chickpea (BB) (1:3) BBF	38.66	35.14	1.50	0.27	-0.27	1.86	0.54
Mustard (F) + Chickpea (NB) (1:2) NBF	37.04	33.67	1.36	0.42	-0.42	2.33	0.43
Mustard (F) + Chickpea (R) (1:1) FIRB	36.01	32.73	1.30	0.26	-0.26	1.51	0.66
CD (p=0.05)	2.68	2.44	0.10	N.S	N.S	N.S	N.S

Table 7. Effect of intercropping system using land configurations on cost of cultivation, gross returns, net returns, benefit cost ratio (BCR) and profitability under the organic management

Treatments / Intercropping systems	Field remained occupied (No. days)	Cost of cultivation (Rs ha ⁻¹)	Gross returns (Rs ha ⁻¹)	Net returns (Rs ha ⁻¹)	B : C	Profitability (Rs ha ⁻¹ day ⁻¹)
Mustard alone (FB)	135	30,350	1,25,620	95,270	3.14	706
Chickpea alone (FB)	133	33,100	88,905	55,805	1.69	420
Mustard (FB) + Chickpea (FB) (1:1) FB	137	31,725	1,31,572	99,847	3.15	729
Mustard (LB) + Chickpea (UB) (2:2) PRS	137	31,725	1,48,797	1,17,072	3.69	855
Mustard (SLB) + Chickpea (R) (2:1) SLBR	137	31,266	1,43,685	1,12,419	3.60	821
Mustard (F) + Chickpea (BB) (1:3) BBF	137	32,183	1,54,618	1,22,435	3.81	894
Mustard (F) + Chickpea (NB) (1:2) NBF	137	32,412	1,48,150	1,15,738	3.57	845
Mustard (F) + Chickpea (R) (1:1) FIRB	137	31,725	1,44,018	1,12,293	3.54	820
CD (p=0.05)	N.S	N.S	10714	10713	0.34	N.S

higher than all other treatments. All the mustard + chickpea row ratios using land configurations recorded significantly higher gross and net returns as compared to the sole cropping of mustard and chickpea. The maximum gross returns of Rs1,54,618 ha⁻¹ and net returns Rs 1,22,436 ha⁻¹ were obtained when mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under Broad bed and furrow (BBF) system of intercropping. The highest benefit cost ratio (3.81) was obtained from mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under BBF system of intercropping which was significantly higher than mustard alone and chickpea alone under flat bed (FB) system and all other mustard + chickpea row ratios. The maximum profitability (Rs. 893.69 ha⁻¹day⁻¹) was noted when in mustard grown in furrows (F) + chickpea on broad beds (BB) in ratio of 1:3 under broad bed and furrow (BBF) system of intercropping.

CONCLUSION

The mustard with chickpea can successfully be grown under organic management using land configurations. The sowing of mustard and chickpea under broad bed and furrow system was found to be better method of intercropping compared to sole cropping of both as the growth attributes were slightly reduced but ultimately the yield in equivalent term was apparently higher. The Broad bed and Furrow system was identified to be most suitable sowing method for obtaining higher yield and net return from mustard and chickpea intercropping system under organic farming in Bundelkhand.

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