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Performance of Mungbean Cultivars under Different Resource Conservation Techniques

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Abstract

The field experiment was conducted during *kharif* season of 2009. The experiment consisting of four resource conservation techniques (RCTs) viz. furrow irrigated raised bed system (FIRBS), conventional tillage (CT), zero tillage (ZT) with 5% wheat residue (WR) and ZT with 30% WR in main plots; and five cultivars MH124, MH125, MH318, MH421 and Satya in sub-plots making twenty treatment combinations was laid out in a split plot design with three replications. Different RCTs had considerable impact on growth, yield attributes and yield of mungbean. FIRBS resulted into better growth and yield of all mungbean cultivars. Maximum growth and net return were also obtained under FIRBS but B : C ratio was higher under ZT 5% WR. Among five mungbean cultivars, MH125 attained more growth and resulted into higher grain yield (909 kg/ha) closely followed by MH124 (865 kg/ha) and Satya (809 kg/ha). MH125 resulted into maximum net return (Rs 21,954/ha) and B : C ratio (1.9).
Key words : Mungbean cultivars, Resource conservation techniques, Furrow irrigated raised bed system, Conventional tillage, Wheat residue.

Greengram known as mungbean is predominantly rainy season crop. Mungbean (*Vigna radiata* L. Wilczok) is an important crop in India as well as in South East Asia. In India, it is cultivated on 3.2 million hectare and production is 0.95 million tones, with an average yield of 304 kg/ha (1). It is grown mainly for its protein rich edible seed. It is also rich in B1, B2, C and calcium, phosphorus and potassium (2) besides an excellent source of high quality protein in diet. It enhances soil fertility through biological fixation in association with *Rhizobium* (3), check soil erosion as cover crop and sometimes used as green manure. Being a short duration crop, it fits well in different sequential and intercropping systems. In spite of its great importance, fewer efforts have been made to improve its yield and quality. Its per hectare yield is low as compared with the yield potential of existing cultivars. Various factors responsible for low yield of mungbean at farmer's field include unawareness of farmers about optimum date of sowing, improper planting patterns, insufficient weed control, pest management practices and imbalance use of fertilizers. Therefore, there is an imminent need to boost up the mungbean production in different states through crop improvement and management options. Sowing of mungbean in rows in flat beds is a common practice. Other planting methods like furrow irrigated raised bed system (FIRBS) and zero tillage have been found effective in solving problems related to weed control, water management, energy saving and nutrient management in various crops including mungbean (4). FIRBS of planting crops can be a viable technology in reducing water losses. Its other advantages are maximum harvesting and utilization under low rainfall, avoidance of temporary flooding, improved drainage under high intensity rainfall, higher nitrogen use efficiency and less lodging (5). No till system and planting of mungbean into in-situ residue mulch reduced seed bed preparing cost and duration and energy requirement, and is one of the sustainable agricultural system, which helps farmers to produce economically enough mungbean grain yield during summer season (6). Zero tillage with at least 30% residue retention has been reported viable in different cropping systems. But reports on such type of studies in India particularly in mungbean grown in sequence with wheat are meager. Moreover, performance of different cultivars under zero tillage and FIRBS needs to be studied to identify most suitable variety under specific tillage system since mungbean is catching

Table 1. Effect of different RCTs and cultivars on plant population, dry weight, plant height and days to maturity by mungbean. FIRBS-Furrow irrigated raised bed system, CT-Conventional tillage, ZT5% WR-Zero tillage with 5% wheat residue, ZT30% WR-Zero tillage with 30% wheat residue.

Treatments	Plant population (No./m²)	Dry weight of plant (g/m²)	Plant height (cm)	Days to maturity
FIRBS	13.9	413.3	77.5	71
CT	13.5	408.1	75.4	68
ZT5% WR	13.2	394.1	72.9	65
ZT30% WR	13.1	402.6	74.3	68
CD at 5%	0.5	11.1	2.5	1.1
MH124	14.0	469.9	90.4	70
MH125	14.1	483.5	82.9	71
MH318	13.2	336.5	62.8	65
MH421	12.4	308.0	65.4	66
Satya	13.5	424.7	73.7	67
CD at 5%	0.7	14.5	4.3	1.0

Table 2. Effect of different RCTs and cultivars on yield, yield attributes and harvest index of mungbean.

Treatments	No. of pods per plant	No. of grains per pod	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
FIRBS	36.6	12.1	35.1	863	2,934	22.6
CT	35.2	11.9	34.2	795	2,792	22.1
ZT5% WR	33.1	11.5	33.1	721	2,676	21.2
ZT30% WR	34.2	11.6	33.7	753	2,690	21.8
CD at 5%	2.0	0.3	1.2	27	70	0.6
MH124	41.3	12.4	31.7	865	3,060	22.0
MH125	48.3	13.0	29.4	909	2,981	23.3
MH318	27.6	11.1	35.5	690	2,497	21.6
MH421	21.7	10.5	40.2	641	2,405	21.0
Satya	34.9	11.7	33.3	809	2,922	21.7
CD at 5%	2.2	0.4	1.7	24	96	0.5

lot of attention of growers in Haryana.

Methods

The field experiment was conducted at CCSHAU, KVK farm, Faridabad. The experimental site is situated at an elevation of 198 meters above mean sea level with latitude 27°62´ to 28°33´ N and longitude of 77°62´ to 77°32´ E in semi-arid, sub-tropical zone. The experimental field was sandy loam in texture having a pH value of 8.1 and 0.43% organic carbon. The average rainfall was 396 mm received during crop growing season. Sowing in flat bed planting was done with seed cum ferti drill keeping row to row distance of 30 cm. Whereas, in bed planting, beds were first made in well prepared seed bed with one pass of bed planter followed by sowing of crop in three rows per bed (90 cm wide). Sowing in zero-till plots was done with zero till seed cum fertilizer drill keeping row to row spacing of 30 cm.

The crop was sown on July 17, 2009 using seed rate of 15 kg/ha. Gap filling and thinning was done at 5 and 13 days after sowing (DAS), respectively. The weeding was done with the help of hand hoe (*kasola*), first at 20 DAS and second at 40 DAS. All others agronomic practices like irrigation were kept normal and uniform across treatments.

Data on plant population, plant height, dry matter production, days to maturity, pods per plant, grains per pod, 1000-grain weight, biological yield, grain yield, straw yield, and harvest index were recorded. Economic evaluation was also carried to find out gross return, net return and B : C ratio. Data collected during the study were statistically analyzed by using the technique of analysis of variance (ANOVA) and to judge the significant difference between means of two treatments at 5% probability level was employed.

Results and Discussion

Plant Population

Plant population of mungbean cultivars significantly influenced by the resource conservation techniques (RCTs). Plant population under FIRBS being at par with CT was significantly more compared to ZT 5% WR and ZT 30% WR at harvest (Table 1). Similarly, Vyn et al. (7) noticed a thinner population of soybean appeared to be associated with no-till treatments. Mungbean on FIRBS had higher plant stand due to the furrows between the raised beds under FIRBS which served as a channel for drainage of excess rain water and saved mungbean crop from water logging. In contrast, Kumar et al. (4) reported no significant variation in plant population of mungbean due to different RCTs. A decrease in plant population in MH-421 and MH-318 was recorded due water logging caused by high rainfall. This might be due to the possible reason that MH421 and MH318 could be

Table 3. Comparative economics of different RCTs and cultivars.

Treatments	Gross return (Rs/ha)	Net return (Rs/ha)	B : C ratio
FIRBS	32,109	18,963	1.4
CT	29,632	18,766	1.7
ZT5% WR	26,993	17,646	1.8
ZT 30% WR	28,112	14,266	1.0
MH124	32,293	20,492	1.7
MH125	33,755	21,954	1.9
MH318	25,790	13,989	1.2
MH421	24,003	12,202	1.0
Satya	30,216	18,415	1.6

more sensitive to water logging compared to other cultivars. Similarly, Elmore (8) found that Mead (cultivar of soybean) had fewer plants per square meter than Williams 82 at both 2 weeks after emergence (32 vs 37) and at maturity (28 vs 34).

Plant Height

Plant height was significantly influenced by the different RCTs (Table 1). Mungbean planted under FIRBS produced taller plants due to maintenance of favorable moisture and avoidance of water logging, which could be two principal reasons for better performance. Similar effects of modified land configuration were already reported in pigeonpea (Kantwa et al., 2005). CT has also been reported to produce significantly more plant height of mungbean than no-till system due to well prepared seed bed in CT (6) and even better than ridge sowing (9). The cultivar MH124 had taller plants than other cultivars (Table 1). This showed that cultivars exploited their genetic potential and the performance was manifested morphologically. Similarly, cultivar effects of soybean on plant height were mediated by the tillage systems (8).

Dry Matter Accumulation in Plants

Dry matter accumulation was higher in FIRBS compared to other treatments (Table 1). This might be due to less weed growth and other favorable growth condition under FIRBS compared to other tillage treatments. In ZT plots, there were higher weed growth which might have reduced photosynthesis area and branches per plant and thereby reduction in dry matter production of crop. In contrast, the dry matter of chickpea at harvest was greater in ZT than CT treatment (10). Dry matter was greater in MH125 than other cultivars. This is possibly due to phenotypic expression of the genetic potential.

Days Taken to Maturity

Days taken to maturity were significantly influenced by the resource conservation techniques and cultivars of mungbean (Table 1). More number of days to maturity were taken (71) in FIRBS due to more moisture availability for longer time. There was significant variation in number of days taken to maturity by the different cultivars.

Yield and Yield Attributing Parameters

FIRBS produced significantly more pods per plant, grains per pod and 1000-grain weight than ZT treatments with 5% wheat residue (Table 2). Malik et al. (9) revealed that in mungbean, number of pods per plant and numbers of grains per pod in ridge sowing were higher compared to flat sowing. Similarly, Blackshaw et al. (11) reported that seed weight of dry bean was lower with ZT that CT at Lethbridge. The cultivar MH125 gave significantly higher pods per plant and grains per pod. This might be due better adaptability and lower weed pressure. Maximum 1000-grain weight was recorded in MH421. This could be due to its genetic potential, bold size and less number of grains per pod.

FIRBS produced significantly more grain yield, biological yield, straw yield and harvest index compared to other treatments but was at par with CT in harvest index (Table 2). Comparison and trend among the mean crop value for the FIRBS, CT, ZT5% WR and ZT 30% WR and five cultivars were very similar to response for grain yield. This might be due to more plant stand, pods number per plant, number of grains per pod and test weight in FIRBS compared to other treatments. This also might be due to avoidance of water logging under FIRBS which could be the principal reason for better performance of mungbean. Grain, straw and biological yield as well as harvest index of mungbean was reported to be influenced by RCTs (4). In contrast, dry bean yield was higher with

ZT than CT in wheat stubble in 2004 (11). Within the no-till system, soybean seed yield declined as the amount of wheat residue increased (7). But under present investigation, grain yield of mungbean under ZT 30% WR was more than ZT 5% WR.

The cultivar MH125 gave a higher grain yield than other cultivars. This was possibly due to more number of pods per plant, grains per pod and plant stand. There was no cultivar × tillage interaction in grain yield. The cultivar MH124 was next in the sequence which gave higher biological and straw yield than other cultivars.

Economics

Gross return and net return under FIRBS were higher compared to other tillage treatments (Table 3). This was due to more grain and straw yield under FIRBS. Similarly, Dhidwal et al. (5) reported that FIRBS-planted greengram gave more net benefit compared with flat sown crop. Lowest gross return was in ZT 5% due to lowest grain and straw yield. Lowest net return was in ZT 30% due to less grain and straw yield and higher cost of cultivation as residue retaining added to cost of cultivation. B : C ratio was higher with ZT 5% due to lowest cost of cultivation compared to other tillage treatments. Aleman (2001) found that in common bean, minimum tillage resulted in an increase in net income that was 23 and 35% greater than NT and CT, respectively. Gross return, net return and B : C ratio was higher with MH125 due higher grain yield. Lowest values were recorded with MH421 (Table 3).

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