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Full Research Article

Effect of Row Ratio on Growth, Nodulation, Yield and Nutrient Uptake in Maize (*Zea mays* L.) with Urdbean and Mungbean Intercropping System

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Abstract

A field experiment was conducted during *kharif* season of 2013 on sandy loam soil at CRC of S.V.P.U.A. & T. Meerut. In this investigation 09 treatment combination viz., maize with normal (1:1), paired (2:2) and strip (3:3) planted urdbean and mungbean along with all the three crops in their sole stands were tested in randomized block design with three replications. The study revealed that strip planted maize+urdbean (3:3) being *on par* with maize+mungbean (3:3) recorded significantly highest values of plant height, plant spread and dry matter accumulation, yield attributes viz., cob length (cm), grains row^{-1}, grains cob^{-1} and test weight (g) and yield of maize in terms of biological yield (123.0 q ha^{-1}) however, harvest index was higher under normal (1:1) maize+urdbean. In terms of nitrogen, phosphorus and potassium uptake in grains and stover and their total uptake of each, strip (3:3) planted maize proved its superiority over sole and normal (1:1) planted maize. Likewise in intercrops, all the growth parameters, nodules plant^{-1}, yield attributes, yields, nutrients uptake and their total uptake were statistically superior in their sole as compared to normal (1:1), paired (2:2) and strip (3:3) planting with maize. Therefore, strip planted maize+mungbean/urdbean (3:3) intercropping system proved to be better growth and development, nodulation, biological yield and their contributing traits and nutrient uptake in grain and stover/straw of crops. Further, atleast one more year research is needed to develop the module for maize+mun/urdbean intercropping system.

1. Introduction

Maize is third most important cereal crop in India after rice and wheat. In India, it occupies an area of about 9.08 million ha and produces 23.29 mt of grains with an average productivity of 2563 kg ha^{-1} (2013–14). The recommended hybrids, in general, have given 60% to 80% or more grain yield than the local varieties with an average yield level of 6 tons or more ha^{-1} (Anonymous, 2013–14).

India is the world largest homeland of vegetarian population and world leader in pulse production and important to provide protein supplements (Singh et al., 2007). Indian pulse production has been stuck in between 14 and 15 mt since mid-nineties, resulting in poor consumption (60 g day^{-1} capita^{-1} in 1951 to 33 g day^{-1} person^{-1} at present). The agro-ecosystems of this region are becoming fragile and the climate change is posing a potential threat for crop production, especially to mungbean and urdbean.

Benefits of intercropping may be briefed as:better use of resources, improvement of soil fertility by legume components of the system, soil preservation through covering the bare land between the rows, reduction of biotic and abiotic risks by increasing diversity, suppression of weeds infestation, etc. Cropping systems varies from place to place in the world. A good system is designed to improve it in a given agro ecological situation based on their superiority over the existing systems which is adapted by the farmers of the area in terms of their biological productivity and stability of production with the least harm to the ecosystem. Farmers generally take decisions on the technologies to be adopted on the basis of cost, risk and return calculations. In small farms, the farmers raise crops as a risk minimizing measures against total crop failures and to get different produces to take of his family food, income, etc. In intercropping system involving legume and non legume, legume may provide nitrogen benefiting non-legume component, which improve nitrogen uptake and fertility status (Dwivedi et al., 2015).

Plant population, days taken to silking, nitrogen contents, yields ha^{-1}, protein content and protein yield in maize and mash bean were superior in maize+mashbean intercropping with paired planting geometry than their sole cropping with other geometries (Dwivedi et al., 2015).Intercropping of maize with urdbean resulted in 9.7 to 11.5% higher grain yield than sole maize grown with normal and paired row planting, respectively. However, yield from the maize+urdbean cropping system was statistically *on par* with that of maize+soybean (Shivay and Singh, 2003). Yield attributes (cobs plant^{-1}, cob length, grains cob^{-1}, grain weight cob^{-1} and weight of cobs/plant and yields were significantly improved in paired row maize (40/80 cm)+one row of mungbean compared to sole maize but was at par with paired row maize+2 rows of mungbean (Shivran and Rana, 2003). Uptakes of N, P and K by blackgram were higher in the sole planting as against maize+blackgram (2:1) intercropping system. They further reported that number and dry weight of nodules was highest in sole blackgram (Dwivedi et al., 2012).

2. Materials and Methods

A field experiment was conducted during *kharif* season 2013 at Crop Research Centre (Chirauri) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), located at a latitude of 29°40′ North and longitude of 77°42′ East with an elevation of 237 metres amsl. The mean weekly maximum temperature was 39.2 °C which was recorded in the last week of June. It decline gradually and reached to its minimum at the time of harvest. Minimum temperature follows the same trend as of maximum temperature, though the lowest temperature was 18.9 °C during the third week of October. The mean weekly relative humidity at 7.00 and 14.00 hrs varied from 80.8 to 59.9 and 73.7 to 23%, respectively. The total rainfall received during crop period was 651.6 mm. The experimental field was well drained, sandy loam in texture (46.2% sand, 18.4% silt and 17.4% clay, Bouyoucos hydrometer method) and slightly alkaline in reaction (pH 7.8, Glass electrode pH meter). The soil was medium in organic carbon (0.542%), organic matter (0.934%), available phosphorus (14.7 kg ha^{-1}) and potassium (177.9 kg ha^{-1}) but low in available nitrogen (201.2 kg ha^{-1}) with an electrical conductivity (1:2, soil: water suspension, Solbridge conductivity meter method) and Bulk density, Core sampler method of 1.6 dS m^{-1} and 1.42 Mg m^{-3}, respectively. All the physic-chemical properties were analyzed as per the slandered procedures given by Jackson, 1973. In this investigation 09 treatment combination viz., maize with normal (1:1), paired (2:2) and strip (3:3) planted urdbean and mungbean along with all the three crops in their sole stands were tested in randomized block design with 3 replications. The crops were grown with recommended agronomic package of practices. The seeds were placed manually in the furrows at a plant to plant distance of 20 and 10 cm with a seed rate of 20, 15 and 15 kg ha^{-1} for maize urdbean and mungbean, respectively and sown on 25 July 2013. The 100% NPK (for maize) is characterized by 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} Two hand weedings, first at 25 days after sowing and second at 45 days after sowing, were done manually with the help of khurpi for controlling weeds. The maize crop is highly sensitive to water stress, both excess and short therefore, surface drains were opened just after sowing to ensure proper drainage. Rains commensurate well with crop water requirement at critical stages so that and only one irrigation was applied at 52 DAS. Observations on plant population, growth parameters viz. plant height, plant spread and dry matter accumulation, phenology, nodules plant^{-1} at 45 DAS and yield attributes at harvest stage of crops were recorded as per standard procedure. The yield was estimated by the produce obtained from net plot area, treatment wise and finally expressed at 14% moisture. Uptake of nitrogen, phosphorus and potassium in maize and urdbean/mungbean calculated by multiplying nitrogen, phosphorus and potassium content with grain yield and straw yield (Tandon, 1998). The data obtained were subjected to statistical analysis as outlined by Gomez and Gomez (1984). The treatment differences were tested by using "F" test and critical differences (at 5% probability).

3. Results and Discussion

3.1. Population studies

The plant population varied from 84200 to 84600 ha^{-1} in maize sole and maize+urdbean (3:3), respectively (Table 1). The highest plant population at maturity was recorded in maize+urdbean (1:1), which was on par with maize sole and maize+urdbean (1:1). Similar findings were also reported by Dwivedi et al. (2015). Moreover, urdbean sole registered the significantly higher plant population (initial as well as at maturity) as compared to maize+urdbean in different row ratios (Table 2 and 3). Although, the minimum values were obtained under strip planted miaze+urdbean (3:3). The similar trend was noticed in mungbean with regards to plant population ha^{-1} (initial and at maturity). Although, the maize+mungbean in different row ratios (1:1), (2:2) and (3:3) did not show any significant variation among themselves, at both the stages.

3.2. Growth parameters

At maturity, highest plantshight (184.9 cm), plant spread (65.0 cm), dry matter accumulation (44.73 g plant^{-1}) were obtained under maize+mungbean (3:3) treatment (Table 1) and the shortest plant height (167.2 cm), plant spread (55.4 cm), dry matter accumulation (35.70 g plant^{-1}) insole maize. The increased values of growth parameters were probably due to the fact that intercrop legume will fix nitrogen from the atmosphere which can be utilized by maize coupled with better resource utilization by border rows due to lesser crop weed competition. Similar findings were also reported by Shadashiv (2004); Dwivedi et al. (2015). Furthermore, at maturity, strip planted urdbean (75.4 cm) and mungbean (90.4 cm) remained *on par* with paired planting (2:2) produces significantly highest plant heightas compared to normal planting (1:1) whereas sole urdbean/mungbean enjoyed more plant spread (39.4 and 45.3 cm) dry matter accumulation (14.70 and 14.93 g plant^{-1}), respectively as compared to row ratio (Table 2 and 2). However, plant height was rapidly decline in their sole stand whereas, plant spread and dry matter accumulation was far lower in maize+urdbean/mungbean (2:2).

3.3. Days taken to silking

The maize took about 46.3 to 47.7 days to silking, although there was not significant variation among sole (Table 1), normal paired and strip planted maize in this regard. The maize took significantly lesser number of days for silking under paired planting as compared to sole and strip planted maize. The probable reason for required more days to silking and maturity was due to border effects. Further, the crop utilized the resources in better way and sizeable amount of nitrogen fixed by urdbean and mungbean can also be utilized by maize crop which delayed the maturity in maize. Similar findings were also reported by Dwivedi et al. (2015).

3.4. Nodules plant^{-1}

Significantly more number of nodules plant^{-1} (70.4) was observed under urdbean sole (Table 2 and 3) which increased to the tune of 30.5% by strip planting (3:3) and remained statistically *on par* with maize+urdbean (1:1) normal (65.6). However, the significantly minimum number of nodule (48.8) plant^{-1} was measured under maize+urdbean (3:3) paired intercropping system. The nodule plant^{-1} reduced significantly with each successive increment in row of maize from sole mungbean to maize+mungbean (3:3), being highest in sole mungbean (65.3 nodule plant^{-1}). The highest uptake was directly related to root growth in terms of number of root nodules plant^{-1}. Similar results were also reported by Tripathi et al. (2008).

3.5. Yield and yield attributes of maize

The highest cob length of 17.7 was noted with maize+urdbean strip intercropping (3:3) which was significantly more than sole maize and normal intercropped maize (1:1). However, the strip planted maize paired (2:2) with urdbean and mungbean did not show any significant difference to each other (Table 1). The highest number of grain rows cob^{-1} was recorded under maize+urdbean (3:3) strip planting and lower number of grain rows cob^{-1} was noticed under sole maize (14.1). Though, the statistically difference between them was not significant (Table 1). Whereas, almostsimilar trend was observed in the number of grains row^{-1}, as in case of grain rows cob^{-1} being highest in strip planted maize+mungbean (32.3).Increase in values of yield attributes probably due to more dry matter accumulation. Our results were also

Table 1: Population studies, growth at maturity, days taken to silking, yield attributes and yield of maize as influenced by various treatments

Treatment	Plant population (000 ha^{-1})		Growth parameters at maturity			Days taken to Silking	Yield attributes			Yield	
	Initial	At maturity	Plant height (cm)	Plant Spread (cm)	Dry matter (g plant^{-1})		Cob length (cm)	Grains row^{-1}	Grains cob^{-1}	Biological yield (q ha^{-1})	Harvest index (%)
Maize Sole	84.2	79.4	167.2	55.4	35.70	46.3	14.6	31.5	445.3	115.6	37.02
Maize+Urdbean (1:1)	84.4	79.6	176.5	57.6	40.83	47.7	15.3	31.1	445.3	118.3	37.32
Maize+Mungbean (1:1)	84.4	79.2	178.4	58.8	41.00	47.3	15.2	31.9	450.7	117.8	37.09
Maize+Urdbean (2:2)	84.3	78.2	180.4	60.5	42.73	47.7	16.4	31.6	464.3	121.2	37.00
Maize+Mungbean (2:2)	84.3	77.8	182.6	61.9	43.13	47.3	16.4	32.1	468.3	120.0	37.08
Maize+Urdbean (3:3)	84.6	78.3	184.3	63.6	43.13	47.3	17.7	31.3	479.3	123.0	37.07
Maize+Mungbean (3:3)	84.4	77.8	184.9	65.0	44.73	46.7	17.6	32.3	481.7	121.9	37.08
SEm±	0.1	0.4	0.4	0.8	1.26	0.6	0.7	0.9	6.3	0.6	0.22
CD (p=0.05)	NS	1.1	1.4	2.4	3.91	NS	1.5	NS	19.64	1.8	NS

supported by Shivran and Rana (2003).

Significantly higher biological yield (123.0 q ha^{-1}) was noticed under maize+urdbean (3:3) strip intercropping system, being *on par* with to maize+mungbean (3:3) strip cropping (121.9 q ha^{-1}) as compared to rest of the treatments (Table 1). However, significantly the lowest biological yield (115.6 q ha^{-1}) ha^{-1} was noted in maize sole. The increase in biological yield was might be due to more photosynthetic activities in maize crop due to more exposure to sun light, besides an increase in values of yield attributes. These result also put forward by Shivran and Rana (2003). However, harvest index (Table 1) maize in varied from 37.00 to 37.32%, although the differences among different treatments were statistically alike.

3.6. *Yield and yield attributes of urdbean and mungbean*

The highest number of grains pod^{-1} (6.5) was noticed under urdbean and minimum number of grains pod^{-1} (5.8) in maize+urdbean strip planting (Table 2 and 3). Though, the difference between them was not significant. Even though, similar trend was also noticed in the context of number of grains pod^{-1} in mungbean, being maximum in sole mungbean. Similar results were also reported by Upasani et al. (2000); Shivran and Rana (2003).

Significantly more number of grains (143.0) plant^{-1} was found under sole urdbean as compared to all other treatments. However, strip planted urdbean recorded significantly lowest number of grains plant^{-1} (138.9), but the differences between normal and paired and paired and strip planted urdbean in this regard were also statistically different. Whereas, Mungbean sole registered significantly more number of grains plant^{-1} (142.7) as compared to normal (1:1), paired (2:2) and strip (3:3) planted mungbean. Though, the differences among

Table 2: Population studies, growth at maturity, nodules plant^{-1} and yield attributes and yield of urdbean as influenced by various treatments

Treatment	Plant population (000 ha^{-1})		Growth parameters at maturity			Nodules plant^{-1} at 45 DAS	Yield attributes			Yield	
	Initial	At maturity	Plant height (cm)	Plant spread (cm)	Dry matter (g plant^{-1})		Grains pod^{-1}	Grains plant^{-1}	Test weight (g)	Biological yield (q ha^{-1})	Harvest index (%)
Urdbean Sole	333.3	311.1	72.3	39.4	14.70	70.4	6.5	143.5	34.9	26.5	30.4
Maize+Urdbean (1:1)	168.6	160.8	72.5	37.5	13.63	65.6	6.3	141.7	33.5	19.7	23.2
Maize+Urdbean (2:2)	168.2	157.6	75.3	35.2	13.30	58.8	6.2	138.9	33.5	18.4	23.9
Maize+Urdbean (3:3)	167.3	155.4	75.4	34.5	13.20	48.8	5.8	137.6	30.2	18.2	23.6
SEm±	0.6	0.8	0.1	1.1	0.30	3.4	0.4	0.4	0.6	0.5	0.9
CD (p=0.05)	2.2	2.7	0.3	3.4	0.95	11.8	NS	1.3	2.1	1.2	2.2

Table 3: Population studies, growth at maturity, nodules plant^{-1} and yield attributes and yield of mungbean as influenced by various treatments

Treatment	Plant population (000 ha^{-1})		Growth parameters at maturity			Nodules plant^{-1} at 45 DAS	Yield attributes			Yield	
	Initial	At maturity	Plant height (cm)	Plant spread (cm)	Dry matter (g plant^{-1})		Grains pod^{-1}	Grains plant^{-1}	Test weight (g)	Biological yield (q ha^{-1})	Harvest index (%)
Mungbean Sole	333.5	311.07	83.5	45.3	14.93	65.3	9.0	142.7	26.2	24.3	29.3
Maize+Mungbean (1:1)	167.8	159.5	85.8	43.6	14.53	55.4	8.9	141.2	25.2	18.5	23.2
Maize+Mungbean (2:2)	167.2	155.2	88.8	40.3	14.20	46.2	8.6	137.6	24.9	17.4	23.6
Maize+Mungbean (3:3)	166.8	154.2	90.4	38.6	13.80	35.4	8.6	136.5	23.5	16.8	21.6
SEm±	0.6	0.8	0.6	0.4	0.11	1.5	0.2	0.6	0.2	0.8	1.4
CD (p=0.05)	2.0	2.8	2.1	1.4	0.40	5.3	NS	2.0	0.7	1.8	3.5

each other were also significant. This might be due to less space available for urdbean/mungbean crop and more competition as compared to sole planting. Similar results were also reported by Upasani et al. (2000). Moreover, significantly higher test weight was recorded under urdbean sole (34.9) and remained statistically on par with normal/ paired planted maize+urdbean (33.5 g) as compared to strip (3:3) planted urdbean (30.2 g).Among the different treatment, mungbean sole (26.2 g) produces significantly recorded higher than normal (1:1) paired (2:2) and strip (3:3) planted maize+mungbean. Although, the normal and paired planted maize+mungbean did not show any significant differences in test weight. However, lowest test weight (23.5 g) was found under strip planted maize+mungbean (3:3).

Strip planted maize+urdbean, being on par with paired planted urdbean significantly reduces the biological yield/ ha as compared to urdbean sole and normal planted maize+urdbean. Though, the difference between urdbean sole and normal maize+urdbean (1:1) was also significant with an improvement of 33.8%. However, mungbean sole registered significantly highest biological yield (24.3 q ha^{-1}) as compared to the intercropping with different row ratios. Though, the per cent reduction in strip planted mungbean was to the tune of 30.9%. This increased was might be due to the favorable source-sink relationship, less competition of light, higher value of yield attributes is the most important source that contributes to the development of sink and higher plant population at maturity. Similar findings were also reported by Shivay and Singh (2003). The harvest index varied from 23.6 to 30.4%, being the highest in urdbean sole and the significantly lowest by strip planted maize+urdbean (3:3). Mungbean sole registered the significantly more harvest index of 29.3% as compare to all the intercropping system, which did not show any significant variation among themselves.

3.7. N, P and K uptake in grains and stover and their total uptake in maize

Significantly higher nitrogen uptake in grains, stover and total was noticed under strip planted maize+urdbean (3:3) and the respective improvement was to the tune of 17.0, 9.5 and 13.5% than sole maize (Table 4). Although, the lowest uptake in grains (61.20 kg ha^{-1}), stover (52.84 kg ha^{-1}) and total (114.0 kg ha^{-1}) was recorded in sole maize. Similar observations were also made by Langat et al. (2006) and Dwivedi et al. (2012). The highest phosphorus uptake in grains was noticed under strip planted maize+urdbean and followed by maize+mungbean (3:3), while lowest was in sole maize. Significantly higher phosphorus uptake in stover was noticed under strip planted maize+mungbean as compared to sole maize and normal planted maize+urdbean (1:1) only. Although, the phosphorus uptake in stover of strip planted maize was dropped by 19.7% in sole maize being the lowest. Significantly higher total phosphorus uptake was noticed under strip planted maize+urdbean, which was *on par* with maize+mungbean as compared to rest of the treatments. The per cent improvement was 28.1 and 27.1 over sole maize. Moreover, the higher potassium uptake in grains was noticed under strip planted maize+urdbean (17.85 kg ha^{-1}). But the differences were not significant (Table 4). Significantly higher potassium uptake in stover was noticed under strip planted maize+mungbean/urdbean, being on par with paired planted maize+mungbean/urdbean as compared to sole maize and normal planted maize+mungbean. Although, the stover potassium uptake in strip planted maize was dropped by 8.7% in sole maize. However, significantly lowest potassium uptake in stover was noticed under sole maize. Significantly highest total potassium uptake was noticed under strip planted maize+urdbean as compared to sole. Although, the normal and paired planted maize did not show any significant difference among the total potassium uptake in strip planted maize (3:3)

Table 4: N, P and K uptake in grain and stover and their total uptake as influenced by various treatments

Treatment	N uptake		Total N uptake	P uptake		Total P Uptake	K uptake		Total K uptake
	Grain	Stover		Grain	Stover		Grain	Stover	
Maize Sole	61.20	52.84	114.04	12.87	9.98	22.85	16.10	108.05	124.15
Maize+Urdbean (1:1)	63.22	54.25	117.46	13.21	10.89	24.10	16.60	114.70	131.30
Maize+Mungbean (1:1)	62.60	54.20	116.80	13.41	10.94	24.35	16.70	113.12	129.82
Maize+Urdbean (2:2)	64.61	56.91	121.52	14.81	11.31	26.12	17.31	116.76	134.07
Maize+Mungbean (2:2)	64.63	56.20	120.83	14.55	12.21	26.76	17.30	117.25	134.55
Maize+Urdbean (3:3)	71.61	57.85	129.46	16.94	12.34	29.28	17.82	118.30	136.12
Maize+Mungbean (3:3)	70.95	57.20	128.15	16.62	12.43	29.05	17.85	118.33	135.18
SEm±	3.30	0.70	2.82	0.93	0.47	0.13	0.40	1.60	1.70
CD (p=0.05)	7.25	1.50	8.80	NS	1.50	0.42	NS	4.90	5.30

was 8.9 to 9.6 more in compression to sole maize. Nutrient uptake is mainly governed by nutrient contentsin grains and stover and their respective yields. Combined action of both led to more uptakes in grains, stover as well as total. Similar observations were also made by Langat et al., (2006).

3.8. N, P and K uptake in urdbean and mungbean

Significantly higher nitrogen uptake by urdbean grains, straw and total uptake was noticed under urdbean sole as compared to maize+urdbean intercropping with different row ratios (Table 5 and 6). The lowest nitrogen uptake by grains, straw and total was recorded under maize+urdbean 3:3, 2:2 and 2:2 row rato, respectively. However, the reduction in strip planted urdbean over sole urdbean was to the tune of 46.8, 10.0 and 28.1% respectively. Whereas, significantly higher nitrogen uptake by mungbean grains, straw and total was noticed under mungbean sole as compared to maize+mungbean intercropping with different row ratios, which remained *on par* to each other. The lowest nitrogen uptake by grains, straw and total was recorded under strip planted maize+mungbean (3:3), paired maize+mungbean (2:2) and paired maize+ mungbean (2:2) respectively. The per cent reduction over sole mungbean was to the tune of 45.3, 16.9 and 29.8, respectively. Similar findings were also reported by Dwivedi et al. (2015). Moreover, significantly higher phosphorous uptake in urdbean grains, straw and total was noticed under urdbean sole as compared to maize+urdbean intercropping with different row ratios (Table 5 and 6). The lowest phosphorous uptake by grains, straw and total was recorded under maize+urdbean (3:3). However, the reduction was to the tune of 50.5, 34.6 and 42.7%, respectively. Whereas, significantly higher phosphorous uptake by mungbean grains, straw and total was noticed under mungbean sole as compared to maize+mungbean intercropping with different row ratios. The lowest phosphorous uptake by grains, straw and total was recorded under strip planted maize+mungbean (3:3) followed by paired planted mungbean (2:2). However, the reduction in grain, straw and total phosphorus was to the tune of 51.5, 34.6 and 42.8%, respectively. This reflected the beneficial effects of sole urdbean and mungbean which are directly related to root growth in terms of number and dry weight of root nodules plant^{-1}, yield and higher plant population at maturity. Similar results were also reported by Singhet al., (1988) and Dwivedi et al. (2012). Likewise, significantly higher potassium uptake by urdbean grains, straw and total was noticed under urdbean sole as compared to maize+urdbean intercropping with different row ratios (Table 2b and 2c). The lowest potassium uptake by grains, straw and total was recorded under maize+urdbean (3:3). However, the reduction from sole urdbean was to the tune of 53.8, 26.5 and 30.9 per cent, respectively. While, significantly higher potassium uptake by mungbean grains, straw and total was noticed under mungbean sole as compared to maize+mungbean intercropping with different row ratios. The lowest potassium uptake by grains, straw and total was recorded under strip planted maize+mungbean (3:3). However, the reduction was

Table 5: N, P and K uptake in grain and straw and their total uptake as influenced by various treatments

Treatment	N uptake		Total N uptake	P Uptake		Total P uptake	K Uptake		Total K uptake
	Grain	Straw		Grain	Straw		Grain	Straw	
Urdbean sole	27.80	28.80	56.60	5.60	5.40	11.00	6.02	31.63	37.65
Maize+Urdbean (1:1)	15.70	25.10	40.80	3.95	3.96	7.91	3.27	25.68	28.95
Maize+ Urdbean (2:2)	15.92	23.61	39.53	3.06	3.92	6.98	2.83	23.48	26.31
Maize+Urdbean (3:3)	14.78	25.91	40.69	2.74	3.53	6.30	2.78	23.25	26.03
SEm±	1.10	0.63	0.87	0.40	0.26	0.26	0.20	0.50	0.60
CD (*p*=0.05)	3.90	2.22	3.08	1.40	0.91	0.90	0.55	1.71	2.13

Table 6: N, P and K uptake in grain and straw and their total uptake as influenced by various treatments

Treatment	N uptake		Total N uptake	P uptake		Total P uptake	K uptake		Total K uptake
	Grain	Straw		Grain	Straw		Grain	Straw	
Mungbean sole	25.12	26.70	51.82	4.74	5.00	9.74	17.20	29.21	46.41
Maize+Mungbean (1:1)	15.40	23.02	38.42	2.91	3.80	6.71	14.24	23.50	37.74
Maize+Mungbean (2:2)	14.20	22.20	36.40	2.50	3.64	6.14	13.32	22.11	35.43
Maize+Mungbean (3:3)	13.73	24.20	37.93	2.30	3.27	5.57	13.15	21..60	34.75
SEm±	1.00	0.70	1.30	0.20	0.11	0.70	0.42	0.74	1.15
CD (*p*=0.05)	3.50	2.40	4.43	0.71	0.40	2.46	1.50	2.62	4.10

to the tune of 50.9, 26.1 26.5 and 29.9%, respectively.Similar results were also reported by Singh et al., (1988) and Singh (1993).

4. Conclusion

Strip planted maize+mungbean/urdbean (3:3) intercropping system proved to be better growth and development, nodulation, biological yield and their contributing traits and nutrient uptake in grain and stover/straw of crops. Further, atleast one more year research is needed to develop the module for maize+mun/urdbean intercropping system.

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