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Effect of tillage and cultural practices on little millet

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Abstract
A field experiment was carried out during rainy season of 2013-14 & 2014-15 at the Instructional Farm, JNKVV College of Agriculture, Rewa (M.P.) "To study the effect of tillage and cultural practices on of little millet". Little millet crop when grown by adopting conservation tillage practices and sowing of pigeonpea as intercrop followed by opening of conservation furrow between paiied rows of pigeonpea (C_2) resulted in better growth and development of little millet over rest of the tillage and cultural practices. Conservation tillage (T_2) was found the most suitable tillage practice for growing little millet crop under skeletal soil. The net return as well as benefit: cost ratio was recorded highest from the treatment (T_2C2) here intereroppidg of little millet pigeonpea was done followed by opening in the ratio of 2:4 conservation furrowes between paired rows of pigeonpea due to the higher price of pigeonpea over the little millet. Whereas, the farmers obtaining for sole- little millet should grow little millet by adopting conservation tillage and application of crop residue as mulch for obtaining higher benefit.

Keywords: Tillage, cultural, practices, instructional, millet

Introduction
Little millet is grown on marginal lands with poor management practices; therefore, Intereropping with pigeonpea is recommended (Anonymous, 2008) [2]. It is getting more attention today due to increasing incidence of less seasonal rainfall, terminal heat, frequent occurrence of extreme weather event coupled with scanty water resources (Singh *et al*. 2009) [9]. When thecro s are intercropped with pigeonpea are found to be advantageous as trthese crops are able to use the growth resources differently and make better use of growth resources than grown in sole cropping. Pigeonpea is a late maturing, tall growing, wide spaced crop with deep root system and can be accommodated with rapidly growing, short duration and statured crops like little millets.

The conservation tillage system impact soil moisture status because it influences infiltration, runoff, evaporation and soil water storage. Conservation tillage system is a method in which at least 30% of soil surface remains covered by crop residues. Conservation tillage as compared to conventional tillage improves soil and water resources, save energy and time, and reduces the cost of agricultural production. As compared to conventional tillage, minimum tillage protects the soil from wind and water erosion, favours microbial growth; improved soil structure, increased infiltration rate, soil respiration, dehydrogenase activity in upper layer, soil organic carbon and soil microbial biomass is significantly congenial in minimum tillage as compared to conventional tillage (Singh *et al*. 2007). Research work on improved tillgage practices coupled with intercropping of little millet with pigeonpea has not been done in Rewa region of Madhya Pradesh in resolving above dead locks the present research was taken up.

Materials and Methods
The field experiment was carried out during the rainy season 2014-15 & 2015-16 at the instructional Farm JNKVV College of Agriculture, Rewa (M.P.) the soil of the experimental field was sandy having pH 7.7, electrical conductivity 0.5 dS/m, organic carbon 0.53%, available N, P_2O and K_2O 225, 12.52 and 443 kg/ha, respectively. The treatments were 2 tillage practices in main plots and 6 cultural practices in the sub-plots.

T_1 Conventional tillage: 4 ploughing + secondary tillage for seed bed preparation farmers practice)
T_2 Conservation tillage/ minimum tillage: 2 ploughing + secondary tillage.
C_1 Opening conservation furrow after every 6 rows
C_2 Intercropping of little millet + red gram and opening conservation furrows between paired rows of pigeonpea
C_3 Mulching with crop residues
C_4 Weedicide application (pre emergent: Isoproturon @ 0.5 kg a.i./ha
C_5 Sole little millet crop
C_6 $C_1 + C_3 + C_4 + C_5$

An uniform basal dose of 20 kg nitrogen and 20 kg phosphorus/ha was applied through urea and DAP and 20 kg nitrogen/ha was applied as top dressing through urea in all treatments.
The little millet variety JK 36 was sown @11 kg seed/ha and pigeonpea variety ICPH-87119 was sown on keeping row to row spacing 30 cm and 60 cm, and plant to plant 10 cm and 45 cm in little millet and pigeonpea, respectively.

Results & Discussion

Morphological observation

It was clearly evident from the findings that plant population per meter row length was recorded maximum (61.08) when the crop of little millet was sown by adopting conservation tillage practices ani intercropping of little millet + red gram followed by opening of conservatior furrow between paired rows of pigeonpea was done. Due to initial slow growth of pigeonpea, ample space for little millet development was available also the conservation furrow supplemented additional batter to crop root zone resulting in better growth Kasbe and Karanjikar, 2009. Result on the periodical changes in plant growth (Table 1) indicate that the plant height in general raised at the faster rate upto 60 days after sowing there after the advancement plant growth was slow upto maturity stage in all the treatments. The number of tillers per meter row length enhanced very fast between 30 to 45 days after sowing. Later the enhancement become slow upto maturity in all the treatments. The fast vegetative growth upto 45 days after sowing responsible for the enhancement in above characters. In presencce of conducive soil and moisture conditions and interaction with the agro-climatic conditions the desired outcome might obtained before the crop enters to the reproductive phase. Our results clearly shows that sowing of little millet with conservation tillage practices and adoption of intercropping with ed gram and opening of conservation furrow have resulting in maximum plant height and higher number of tillers at all the most stages of growth The variation in growth factor (plant height and number of tillers per plant in little millet) have been reported by Kumar *et al*. 2009 [4].

Phenological observation

In its life cycle plant passes through various stages among them phenological stages has its own importance. As pe- the finding, mean of the days taken to tillering initiation, days taken to 50°,panicle emergence and days taken to physiological maturity were significar tly effective due to tillage and cultural practices. Conservation tillage surpassed the conventional tillage in term of above stated characters as lesser weed growth as compared to conservation tillage resulted in better utilization of nutrient by the little millet crop. Similar result has been reported by Shanmugom, 2008. Among the cultural practices, sowing of little millet crop with red gram as an intercrop and opening conservation furrow after every 6th rows resulted in better expression of phenological characters over rest of the cultural practices as enhanced nitrogen fixation due to root nodulation in pigeonpea coupled with prolonged moisture availability by the means of conservation furrow resulted in this outcome. Singh *et al*. 2009 [9] were of the same opinion.

Growth observation

The chief characters of number of leaves/plant leaf area index and dry matter accumulation govern the growing habits of a crop. Both tillage and the cultural practices had a significant effect upon growth characters. Little millet crop sown by adopting conservation tillage practices gave better expression of growth characters *viz*; number of leaves/plant, leaf area index and dry matter production. It might be due to the fact that conventional tillage practices result in losses of soil water and nutrient in field and degraded with low organic matter content and a fragile physical structure which in turn led to low crop yields. Similar finding has been reported by Wang. *et al*., 2007 [12], Lal, 2002 and Kishor, *et al*., 2013. Intercropping of little millet along with red gram and opening of conservation furrow resulted in highest mean number of leaves per plant. So LAI was in line with the nurnt.er of leaves/plant. Enhanced number of leaves/plant contributed to increased plant fresh weight and finally to the dry matter production. Salhin, *et al*., 2013 [7], Palaniappan and Sivaraman, 1994 [5] and Subbareddy and Venkateshwarlu. 1992 [11] were of same opinion.

Yield attributing characters

The final outcome of crop is yield which is directly govern by various yield attributing characters. As per the present finding the yield attributing characters *viz*, number of panicle/meter row length, length of panicle (cm), number of grains/panicle, weight of grains/panicle and test weight (g) all were significantly influenced by the tillage and cultural practices. The above stated yield attributes were found maximum under conservational tillage practices. Sowing of little millet under intercropping system along with opening of conservation furrow proved superior and resulted in higl er value for all the yield attributing characters. The most possible explanation for better yield attributer under this cultural practices may be that the beneficial effect of nitrogen fixation by legume supported the better expressicn of yield attributes. The variation in yield attributing characters in little millet and other small millets have also been reported by many research workers. Singh and Arya, 1994 [8], Annual report 2000-2001, Patil, *et al*., 2010 [6].

Grain and straw yield

The results from the present experiment clearly indicates that tillage and the cultural practices had a significant effect on grain and straw yield highest grain yield to the tune of 0.15q/ha was obtained under conservation tillage. Which was higher conventional tillage practices. Among cultural practices mulching with crop residues resulted in highest grain yield of 7.70q/ha which was lowest yielding treatment opening conservation furrow after every 6th rows. This might be due to the fact that mulching resulted in conservation of soil moisture and also prevented the loss of nutrient from soil and resulted in better expression of yie d attributes and yield. This finding support the work of Yadav, *et al*., 2007 [13]. This it is possible to asses the productivity of any cropping system with the productivity of only an individual crop component. Therefore combined yields of all components grown under a

particular cropping sequence was determined as little millet equivalent yield on the basis of prevailing market price of the produce for an individual crop component under a particular cropping system play an important role on the little millet equivalent yield.

The little millet equivalent yield has been given in Table 3 reveals that little millet + red gram gave 6.7q/ha little millet grain equivalent yield which was significantly superior over all the cultural practices. This finding support the work of Singh, *et al*., 2009 [9]. Kumar, *et al*., 2009 [4], Patil *et al*., 2010 [6]. Likewise straw yield was also found to be higher under conservation tillage practices. Whereas. Among the cultural practices mulching with crop residues resulting higher straw and opening conservation furrow after every 6th rows resulted in lowest straw yield.

Economics

The final outcome of crop production is represented in terms of monetary returns being obtain from the crop. Economics of the different treatment is directly related to the success of that particular treatment and the extra input and output due to that treatment. The highest net income was Rs.20217 Rs./ha in case of (C_2) intercropping of little millet + red gram and opening conservation furrows between paired rows of pigeonpea arc' the lowest net income was Rs.1497 Rs./ha in case of C. The calculation of benefit: cost ratio is the another way of expressing the economics of the treatments. It is based on the income as against the total expenditure incurred on that particular treatment. In the present study, the B:C ratio each treatment was obtained exactly in accordance with the net income received from that treatment. Accordingly treatment C2 registered the highest B:C ratio upto 2.20 and the lowest B:C ratio 1.12 was obtained in case of C_1 treatment. The maximum loss may be due to the fact that the treatment C_1 possessed opening conservation furrow after every 6th rows. The C_3 treatment stood the second best in the economical grain because of lowest input cost, check weed growth and conserve soil moisture etc.

Table 1: Growth parameters of little millet as influenced by tillage and cultural practices

Treatments	Plant population/m row length (15 DAS)	Plant height (cm) at maturity)	No. of tillers/m row length (at maturity)	Days to tillerign initation	Days to 50% panicle emergence	Days to physiological maturity	Number leaves/plant (at maturity)	Leaf area index (at maturity)	Dry matter production/plant
Tillage									
T_1	60.25	97.41	155.39	26.58	39.50	64.08	10.42	0.73	1.90
T_2	61.08	98.08	156.44	27.75	40.75	65.25	11.00	0.91	2.08
S.Em±	0.08	0.04	0.10	0.06	0.20	0.10	0.08	0.01	0.02
C.D. (P=0.5)	0.23	0.17	0.39	0.23	0.80	0.40	0.24	0.06	0.07
Cultural practices									
C_1	56.83	93.25	151.61	25.50	37.83	62.50	8.57	0.33	1.64
C_2	65.83	101.45	162.50	28.50	43.00	66.50	13.50	1.56	2.36
C_3	60.83	99.26	155.78	27.83	40.50	65.50	10.97	0.86	2.14
C_4	59.17	97.02	153.78	26.83	39.17	64.17	9.80	0.53	1.83
C_5	-	-	-	-	-	-	-	-	-
C_6	-	-	-	-	-	-	-	-	-
S.Em±	0.07	0.04	0.08	0.10	0.21	0.20	0.06	0.01	0.02
C.D. (P=0.5)	0.20	0.11	0.25	0.31	0.62	0.81	0.17	0.04	0.06
Interaction	0.35	0.19	0.43	0.53	NS	NS	0.30	0.12	0.011

Table 2: Yield attributes of little millet as influenced by tillage and cultural practices

Treatments	No. of panicles/ meter row length	Length of panicle (cm)	Number of grain/panicle	Weight grains/panicle	Test weight (g)
Tillage					
T_1	36.31	31.03	673.62	1.61	2.35
T_2	37.00	32.47	686.30	1.75	2.52
S.Em±	0.04	0.15	1.33	0.02	0.03
C.D. (P=0.5)	0.15	0.60	5.21	0.08	0.10
Cultural practices					
C_1	32.50	25.53	513.33	1.14	0.22
C_2	41.56	37.39	852.57	2.25	2.64
C_3	37.56	33.47	746.70	1.90	0.54
C_4	35.17	30.60	606.73	1.42	2.34
C_5	-	-	-	-	-
C_6	-	-	-	-	-
S.Em±	0.03	0.16	2.78	0.02	0.00
C.D. (P=0.5)	0.08	0.48	8.26	0.06	0.01
Interaction	0.13	0.84	Ns	Ns	0.02

Table 3: Yield and economics from little millet as influenced by tillage and cultural practices

Treatments	Little millet grain yield (q/ha)	Little millet straw yield q/ha)	Pigeonpea grain yield (q/ha)	Pigeonpea straw yield (q/ha)	Little millet equivalent yield	Harvest index (%)	Gross income (Rs/ha)	Cost of cultivation (Rs/ha)	Net income (Rs/ha)	B:C ratio
Tillage										
T_1	6.15	22.50		6.82	6.50	21.95	21340.83	15597.82	5743	1.33
T_2	6.78	26.25		7.22	7.07	20.95	23312.67	14438.34	8847	1.58

S.Em±	0.102	0.204			0.06					
C.D. (P=0.5)	0.401	0.801			0.37					
Cultural practices										
C_1	4.20	13.50			4.20	23.76	13950	12453.32	1497	1.12
C_2	6.70	23.50	1.55	6.45	11.35	22.29	37060	16843.32	20217	2.20
C_3	7.70	32.50			7.70	19.18	26350	16240.82	10109	1.63
C_4	7.25	28.00			7.25	20.57	24550	16463.45	8087	1.49
C_5	-	-	-	-	4.95	-	15550	13732.14	1818	1.14
C_6	-	-	-	-	5.25	-	16500.5	14374.95	2126	1.15
S.Em±	0.118	0.272			0.13					
C.D. (P=0.5)	0.350	0.809			0.04					
Interaction	0.607	1.401			NS					

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