Effect of tillage and cultural practices on little millet

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DOI: https://doi.org/10.22271/chemi.2021.v9.i1u.11430

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 paired rows of pigeonpea (C2) resulted in better growth and development of little millet over rest of the tillage and cultural practices. Conservation tillage (T2) 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 (T2C2) here intercropping of little millet pigeonpea was done followed by opening in the ratio of 2:4 conservation furrows 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, Intererropping 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 thse 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 tillage 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, P2O5 and K2O 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<sub>1</sub> Conventional tillage: 4 ploughing + secondary tillage for seedbed preparation farmers practice
T<sub>2</sub> Conservation tillage/ minimum tillage: 2 ploughing + secondary tillage.
C<sub>1</sub> Opening conservation furrow after every 6 rows
C<sub>2</sub> Intercropping of little millet + red gram and opening conservation furrows between paired rows of pigeonpea
C<sub>3</sub> Mulching with crop residues
C<sub>4</sub> Weedicide application (pre emergent: Isoproturon @ 0.5 kg a.i./ha
C<sub>5</sub> Sole little millet crop
C<sub>6</sub> C<sub>1</sub> + C<sub>3</sub> + C<sub>4</sub> + C<sub>5</sub>

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 and intercropping of little millet + red gram followed by opening of conservation 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 up to 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 up to maturity in all the treatments. The fast vegetative growth up to 45 days after sowing responsible for the enhancement in above characters. In presence 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<sup>[4]</sup>

Phenological observation
In its life cycle plant passes through various stages among them phenological phases has its own importance. As per the finding, mean of the days taken to tillering initiation, days taken to 50° panicle emergence and days taken to physiological maturity were significant 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 Shanmugum, 2008. Among the cultural practices, sowing of little millet crop with red gram as an intercrop and opening conservation furrow after every 6<sup>th</sup> 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<sup>[9]</sup> 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<sup>[12]</sup>, 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 theurnt.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<sup>[7]</sup>, Palaniappan and Sivaraman, 1994<sup>[5]</sup> and Subbareddy and Venkateshwarlu. 1992<sup>[11]</sup> 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 higler 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 expression 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<sup>[8]</sup>, Annual report 2000-2001, Patil, et al., 2010<sup>[6]</sup>.

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 6<sup>th</sup> 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<sup>[13]</sup>. 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 [8]. 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 (C2) 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 C1 treatment. The maximum loss may be due to the fact that the treatment C1 possessed opening conservation furrow after every 6th rows. The C3 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 tiller initiation | Days to 50% panicle emergence | Days to physiological maturity | Number leaves/plant (at maturity) | Leaf area index (at maturity) | Dry matter production/plant |
|------------|--------------------------------------|-------------------------------|------------------------------------------|--------------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------|--------------------------|
| T1         | 60.25                                | 97.41                         | 155.39                                   | 26.58                    | 39.50                       | 64.08                       | 10.42                         | 0.73                         | 1.90                     |
| T2         | 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                     |

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) |
|------------|-----------------------------------|------------------------|-------------------------|-----------------------|-----------------|
| T1         | 36.31                             | 31.03                  | 673.62                  | 1.61                  | 2.35            |
| T2         | 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            |

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 |
|------------|----------------------------------|----------------------------------|-----------------------------|-----------------------------|------------------------------|-------------------|----------------------|------------------------|------------------|-----------|
| T1         | 6.15                             | 22.50                            | 6.82                        | 6.50                        | 21.95                        | 21340.83          | 15597.82             | 5743                   | 1.33             |
| T2         | 6.78                             | 26.25                            | 7.22                        | 7.07                        | 20.95                        | 23312.67          | 14438.34             | 8847                   | 1.58             |
### Cultural practices

| S.Em± | 0.102 | 0.204 | 0.06 |
|-------|-------|-------|------|
| C.D. (P=0.5) | 0.401 | 0.801 | 0.37 |

#### References

1. Anonymous. Response of pre-release varieties of kodo millet to levels of N under rainfed conditions. Annual report. All India Co-ordinated Small Millet Improvement Project., College of Agriculture, Rewa (M.P.) 2000-01.
2. Anonymous. Annual Progress Report. All India Coordinated Research Project of Small Millet. J.N.K.V.V. College of Agriculture. Rewa (M.P.) 2008.
3. Kasbe AB, Alasankari BK. Production potential of soybean pigeonpea intercropping agri. J soil Sci 2003;4(1):146-148.
4. Kumar BHP, Halikatti SI, Ninganur BT. Sustainable intercrop association of pigeonpea (*Cajanus cajan*) in little millet (*Panicum sumatrence* L.) Karn. J Agri. Sci 2009;22(4):887-888.
5. Palaniappan SP, Sivaraman K. In: Cropping systems in the tropics in principles and management, 2nd Ed. New age International Pvt. Ltd., Publishers, New Delhi 1994.
6. Patil NB, Halikatti SI, Sajay YH, Kumar PBH, Topagi SC, Pushpa V. Influence of intercropping on the growth and yield of little millet and pigeonpea. Int. J Agri. Sci 2010;6(2):573-577.
7. Salhin N, Alam MK, Islam MM, Naher L, Majid MN. Effect of green manure crops and tillage practice on maize and rice yields and soil properties. Australian Journal of Crop Science 2013;7(12):1901-1911.
8. Singh RV, Arya MPS. Response of finger millet (*Eleusine coracana*) varieties to nitrogen under rainfed condition. Indian J Agron 1994;39(1):125-128.
9. Singh UK, Bharti N, Kumar V. System productivity and profitability of pigeonpea based intercropping under rainfed condition. J Appl. Boil 2009;19(1-2):23-26.
10. Shanmogon BM. Production potential one economius of pigeonpea (*Cajanus cajan*) based intercropping system with different levels and form of P.J. farming systems research and development 2008;14 (1):118-112.
11. Subbreddy G, Venkateshwara S. Effect of planting pattern of yield and moisture use efficiency in sunflower pigeonpea intercropping system. Ind. J Agron 1992;37(4):659-665.
12. Wang XB, Cai DX, Peradok UD, Hoogmod WB, Ocnema O. Development in conservation tillage in rainfed regions of North China. Soil Till. Res 2007;93:239-250.
13. Yadav DR, Dahal KR, Basnet KB, Chaudhary NK, Dulbury JM. Effect of tillage on weed growth and yield of wheat in relation to time of nitrogen application and mulch. Ins. Agri. Ani. Sci (IAAS) Res. Adv 2007;1:31-36.