



E-ISSN: 2278-4136

P-ISSN: 2349-8234

JPP 2018; 7(2): 1051-1055

Received: 20-01-2018

Accepted: 22-02-2018

**Raj Kumar**

Department of Soil Conservation  
and Water Management, C.S.  
Azad University of Agriculture  
and Technology, Kanpur, Uttar  
Pradesh, India

**Munish Kumar**

Department of Soil Conservation  
and Water Management, C.S.  
Azad University of Agriculture  
and Technology, Kanpur, Uttar  
Pradesh, India

**Sarvesh Kumar**

Department of Soil Conservation  
and Water Management, C.S.  
Azad University of Agriculture  
and Technology, Kanpur, Uttar  
Pradesh, India

**Mahak Singh**

Department of Genetics and  
Plant Breeding, C.S. Azad  
University of Agriculture and  
Technology, Kanpur, Uttar  
Pradesh, India

**Mangal Prasad**

Department of Agricultural  
Economics & Statistics, C.S.  
Azad University of Agriculture  
and Technology, Kanpur, Uttar  
Pradesh, India

**Correspondence****Raj Kumar**

Department of Soil Conservation  
and Water Management, C.S.  
Azad University of Agriculture  
and Technology, Kanpur, Uttar  
Pradesh, India

## Quality parameters, moisture studies and economics of mustard 'Basanti' under different date of sowing and moisture conservation practices under rainfed eco-system of central Uttar Pradesh

**Raj Kumar, Munish Kumar, Sarvesh Kumar, Mahak Singh and Mangal Prasad**

**Abstract**

An experiment was conducted on - Responses of mustard 'Basanti' under different date of sowing and moisture conservation practices under rainfed eco-system of central Uttar Pradesh during rabi 2011 on Soil Conservation and Water Management Farm, C.S.A. University of Agriculture & Technology, Kanpur on mustard 'Basanti' with three date of sowing i.e. 20<sup>th</sup> October (D<sub>1</sub>), 28<sup>th</sup> October (D<sub>2</sub>) and 05<sup>th</sup> November (D<sub>3</sub>) with four levels of moisture conservation practices viz; M<sub>0</sub> (Control), M<sub>1</sub> (Paddy Straw Mulch), M<sub>2</sub> (Dust Mulch) and M<sub>3</sub> (Kaoline @ 6% Spray). On the basis of results it can be concluded that the date of sowing D<sub>1</sub> (20th October) as water use 191.86 (mm) & water use efficiency 8.03 (kg ha<sup>-1</sup> mm<sup>-1</sup>) and M<sub>1</sub> (Paddy Straw Mulch) as water use 180.21 (mm) & water use efficiency 9.89 (kg ha<sup>-1</sup> mm<sup>-1</sup>) was found better in respect as compared to other combinations of fertility management in respect of water use & water use efficiency ended that growing of mustard crop in rabi season was found most suitable and remunerative in central plain zone of Uttar Pradesh in Kanpur.

**Keywords:** oil per cent economics, water use efficiency, consumptive use and rainfed

**Introduction**

Rapeseed-mustard are the major *rabi* oilseed crops of the country. Among the oilseeds (*Brassica juncea* L.) mustard is the most important member of the group because more than 80 per cent of the area under rapeseed mustard is followed by toria, yellow sarson, gobhi sarson, and brown sarson. Uttar Pradesh is second largest producer of rapeseed mustard after Rajasthan having 7.20 lakh ha area contributing 8.15 lakh metric tonnes production and 9.89 q/ha productivity recorded in the year 2009-10 (Anonymous, 2010)<sup>[4, 5]</sup>. Among oil seed crops mustard (*Brassica juncea* L.) is a major *rabi* oil seed crop of India being next in importance both in area and production. India is the second largest producer of rapeseed and mustard after China, which contributes about 24.2 per cent of world production, while India has 21.7 per cent of total area and 10.7% production. However, the productivity of oilseeds in India is only 952 kg/ha as compared to whole world level of 1950 kg/ha (Economic Survey of India, 2010)<sup>[4]</sup>.

Date of planting has influence on the performance of mustard crop. Since the rate of development of mustard crop, its yields is greatly influenced by meteorological, edaphic and biotic factors, therefore, planting of mustard crop either to early or too late than the optimum is likely to have an adverse effect on the growth and yield of mustard to the first for night of October (Bhan, 1981)<sup>[10]</sup>.

Soil moisture is the key input in rainfed agriculture. The crop production is often low due to poor soil moisture in rabi season when the crop is raised on conserved soil moisture. The availability of moisture in rainfed condition is very critical during crop period. The successful crop production in area, therefore, depends on the practices which ensure sustained supply of moisture. Moisture conservation practices viz straw mulch, dust mulch, created by weeding and hoeing and weed control have been found effective to check evaporation of moisture from soil surface and thus making more moisture availability during crop period. Green coral cuper (*Antigononptpus*) mulch, rice straw mulch and soil mulch conserved more water in soil profile and increased the grain yield by 47, 43 and 16 per cent and water use efficiency by 61, 56 and 19 per cent, respectively over no mulch treatment in rapeseed mustard crop under rainfed condition (Maitra and Ghosh, 1998).

With the rapid growth of population in recent times, pressure on land increased and the size of holdings considerably decreased in spite of extending the cultivation to marginal and sub-marginal lands. The problem of preventing the crop failures becomes more acute in dry tracts and calls for immediate attention of its solution in every possible way. The need for scientific approach towards farming in rainfed areas was felt with the increasing realization that instead of waiting and hoping for adequate rain, the modern concept is to make the cropping strategy so flexible that it can be suitably changed even at short notice to suit the pattern of rainfall available. To meet the water requirement of the crop plants it is essential to adopt such management practices which may help in retention of moisture in the soil at least till the crop needs. Every effort should be made to increase the amount of water available to the crop for production and reduce to the minimum the loss of water due to evaporation and transpiration. Keeping all these in view, a field experiment was conducted to work out the moisture conservation practices along with date of sowing for mustard varieties to optimize production and net returns under rainfed condition.

### Materials and Methods

A field experiment was conducted during *rabi session*, 2011-12 at Soil Conservation and Water Management Farm of C.S. Azad University of Agriculture and Technology, Kanpur. The soil of the experimental field was sandy loam having 0.31% organic carbon, 0.033% total -N, 18.32 kg ha<sup>-1</sup> available P<sub>2</sub>O<sub>5</sub> and 184.23 kg ha<sup>-1</sup> available K<sub>2</sub>O. It was slightly alkaline with 7.6 pH and 0.345 dSm<sup>-1</sup> electrical conductivity. The field capacity, wilting point and bulk density of surface soil were 18.52%, 6.10% and 1.50 Mg m<sup>-3</sup>, respectively. The treatments comprised 12 combinations of 3 Date of sowing (20<sup>th</sup> Oct., 28<sup>th</sup> Oct. and 05<sup>th</sup> November) and 4 moisture conservation practices (Control, Paddy Straw Mulch @ 4 tonnes/ha at 25 DAS, Dust mulch at 25 DAS and Kaoline @ 6 per cent spray at 25 and 50 DAS) which were tested in a randomized block design with three replications. The gross plot size was 5.0 x 3.6 m in the case of 45 and 15 cm spacing, respectively. An uniform dose of 80 kg N + 40 kg P<sub>2</sub>O<sub>5</sub> + 40 kg K<sub>2</sub>O ha<sup>-1</sup> was applied through Urea, Di-ammonium phosphate and Muriate of potash, respectively. Rainfall during crop growing season was 164.4 mm during crop period respectively. The sowing of mustard crop was done on 20<sup>th</sup> Oct., 28<sup>th</sup> Oct. and 05<sup>th</sup>

November during 2011 and harvesting on 19 March during 2012 respectively. Recommended package of cultural practices was followed. The soil moisture of the sample collected from 0-25, 25-50, 50-75 and 75-100 cm depth was determined thermo gravimetrically at different stages of crop growth. The amount of moisture used by the crop under different treatments was computed by summing up the values of soil moisture depletion from the profile during the entire crop season. The WUE of the crop was calculated by the method described by Viets (1962) [35].

## Results and Discussion

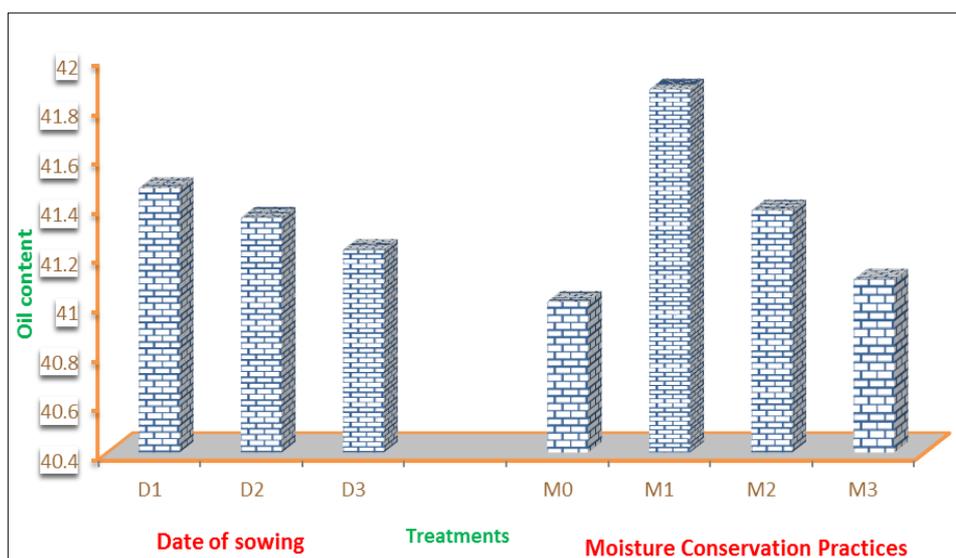
### Quality Parameters

#### Oil content (%) in mustard

The result with respect to economics in relation to moisture conservation practices and date of sowing are presented in Table 01 & Fig 01. Oil content (%) mustard was recorded significantly higher in first sowing 20<sup>th</sup> October. These might be Oil content (%) in sowing 28<sup>th</sup> October. Among the moisture conservation practices Paddy Straw Mulch (M<sub>1</sub>) gave the maximum oil content in comparison to control (M<sub>0</sub>) and timely sowing of crop gave the maximum oil content over delay sowing of crop. As regard oil content, there is slight increase of oil in moisture conservation practices, it is probably due to higher grain weight. However, in case of date of sowing decreasing trends were observed by Panday (1992), Singh and Chauhan (1999) [32], Ramesh *et al.* (2010) [24].

**Table 1:** Effect of sowing date and moisture conservation practices on oil content of mustard

Treatments	Oil content (%)
<b>Date of sowing</b>	
D <sub>1</sub> (20 <sup>th</sup> -October)	41.47
D <sub>2</sub> (28 <sup>th</sup> October)	41.35
D <sub>3</sub> ( 05 <sup>th</sup> November)	41.22
SE (diff) ±	0.01
CD at 5%	0.08
<b>Moisture Conservation Practices</b>	
M <sub>0</sub> (Control)	41.01
M <sub>1</sub> (Paddy Straw Mulch)	41.87
M <sub>2</sub> (Dust Mulch)	41.38
M <sub>3</sub> (Kaoline@6% Spray)	41.10
SE (diff) ±	0.02
CD at 5%	0.09



**Fig 1:** Effect of sowing date and moisture conservation practices on oil content

### Moisture studies

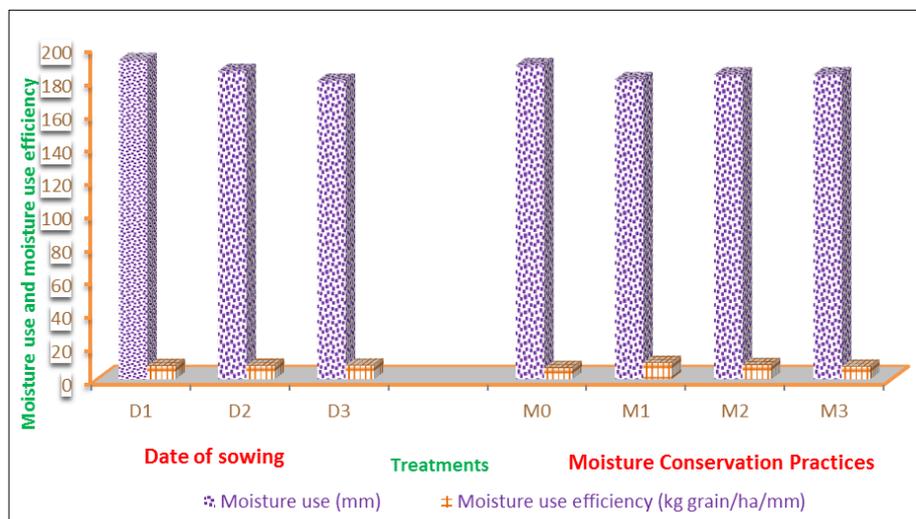
#### Moisture use (mm) and Moisture use efficiency (kg grain/ha/mm)

Soil moisture up to one metre depth (mm) was recorded higher data presented in Table 02 & Fig 02., revealed that maximum water use as well as water use efficiency recorded in crop sown on 20<sup>th</sup> October which were in decreasing trends with delay sown on 05<sup>th</sup> November. It is clear from the result that minimum water use and maximum water use efficiency were recorded under Paddy Straw Mulch (M<sub>1</sub>) practice of

moisture conservation, closely followed by Dust Mulch (M<sub>2</sub>) practices of moisture conservation, by Kaoline @ 6% spray (M<sub>3</sub>) and maximum in Control (M<sub>0</sub>). Better moisture conservation under ridging and furrowing plots have been reported by number of research workers Bhan *et al.* (1992), Kanaujia *et al.* (1996) [17], Singh *et al.* (1996), Mittal *et al.* (1997), Sachan *et al.* (1997) [27, 28, 29] Kumar (1998). Moitra and Ghose (1998) [22], Dhram Raj pal (1999), Katiyar (2001) [19], Dhal *et al.* (2002) and Katiyar (2008).

**Table 2:** Effect of sowing date and moisture conservation practices on moisture use and moisture use efficiency of mustard.

Treatments	Moisture use (mm)	Moisture use efficiency (kg grain/ha/mm)
Date of sowing		
D <sub>1</sub> (20 <sup>th</sup> October)	191.86	8.03
D <sub>2</sub> (28 <sup>th</sup> October)	185.24	8.15
D <sub>3</sub> (05 <sup>th</sup> November)	179.36	8.26
Moisture Conservation Practices		
M <sub>0</sub> (Control)	188.76	6.75
M <sub>1</sub> (Paddy Straw Mulch)	180.21	9.89
M <sub>2</sub> (Dust Mulch)	183.10	8.58
M <sub>3</sub> (Kaoline @ 6% spray)	183.20	7.60



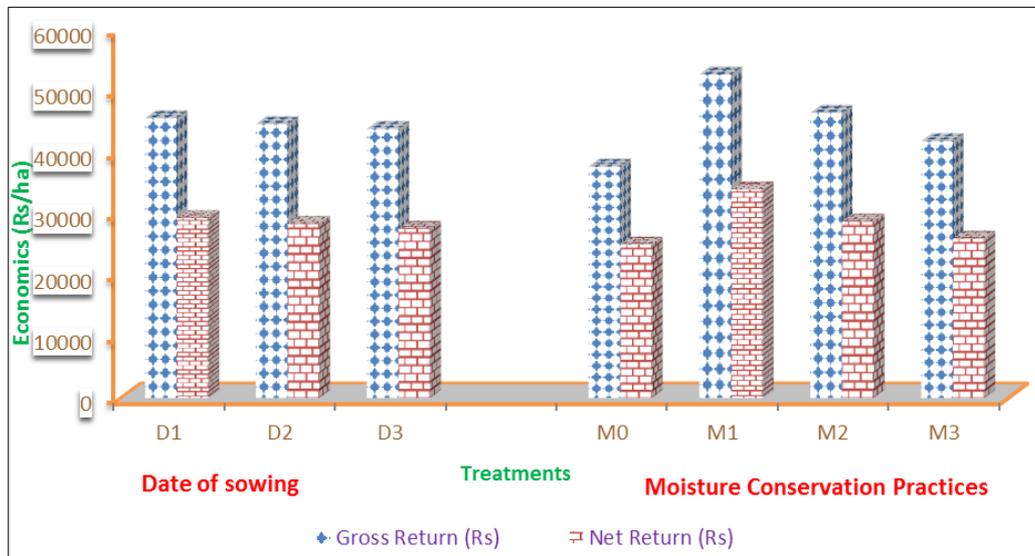
**Fig 2:** Effect of sowing date and moisture conservation practices on moisture use and moisture use efficiency

### Economics

The result with respect to economics in relation to moisture conservation practices and date of sowing are presented in Table 03 & Fig 03. Higher that maximum net return was found under sowing date of 20<sup>th</sup> October (D<sub>1</sub>) treatment closely followed by sowing date of 28<sup>th</sup> October (D<sub>2</sub>) and lowest with sowing date of 5<sup>th</sup> November (D<sub>3</sub>). Similar results were also found by Katiyar (2001) [19], Awasthi *et al.* (2007) [7]. Among moisture conservation practices maximum net return was obtained from Paddy straw mulch (M<sub>1</sub>) followed by Dust mulch (M<sub>2</sub>). The lowest net return was recorded with control (M<sub>0</sub>) treatment. Similar results were also found by Yadav *et al.* (1994) [37], Katiyar (2001) [19], Awasthi *et al.* (2007) [7].

**Table 3:** Effect of sowing date and moisture conservation practices on Gross Return (Rs) and Net Return (Rs) of mustard.

Treatments	Gross Return (Rs)	Net Return (Rs)
Date of Sowing		
D <sub>1</sub> (20 <sup>th</sup> October)	45481.62	29261.99
D <sub>2</sub> (28 <sup>th</sup> October)	44530.25	28310.62
D <sub>3</sub> (05 <sup>th</sup> November)	43733.75	27514.14
Moisture Conservation Practices		
M <sub>0</sub> (Control)	37642.00	24942.00
M <sub>1</sub> (Paddy Straw Mulch)	52598.50	33919.99
M <sub>2</sub> (Dust Mulch)	46344.50	28697.50
M <sub>3</sub> (Kaoline @ 6% Spray)	41742.50	25889.50



**Fig 3:** Effect of sowing date and moisture conservation practices, on economics (Rs/ha)

### Conclusion

On the basis of result obtained during the present investigation different treatment have led to the conclusion that mustard variety 'Basanti' sowing on 20th October supplemented with moisture conservation practices ( $M_1$ ) paddy straw mulch was found more remunerative *i.e.* the oil content of mustard under different treatments were almost at par and showed no systematic variation under various treatments. Moisture conservation practices helped in retaining more moisture in soil hence total moisture total moisture use reduced as compared to control ( $M_0$ ) which gave the maximum moisture use of ( $M_2$ ) and the minimum moisture use was observed in ( $M_3$ ) treatment. The other moisture conservation practices in ( $M_3$ ) treatment. The other moisture conservation practices have also showed positive response in this respect and more or less at par values. The water use efficiency was highest under ( $D_1M_1$ ) treatment combination, while the lowest water use efficiency in control ( $D_3M_0$ ) treatment combination. Moisture conservation practices ( $M_1$ ) gave highest net and gross return was observed under control ( $M_0$ ) moisture conservation practice. under rainfed condition of central Uttar Pradesh.

### Acknowledgements

With limitless humility, I bow my head to Almighty, Merciful Compassionate and Supreme power 'God' who showered his mercy on me and blessed me with the favorable circumstances to go through his gigantic task. I feel it to be my proud privilege and great pleasure to express my deep sense of gratitude and sincere appreciation to my advisor Dr. Munish Kumar, Professor, Soil Conservation and Water Management and equally sincere thank are also due to Members of Advisory Committee Dr. Mangal Prasad, Associate Professor, Department of Agricultural Economics & Statistics, Dr. Mahak Singh, Breeder (Repeseed and Mustard), Department of Genetics and Plant Breeding, Dr. Sarvesh Kumar, Associate Professor Soil Conservation and Water Management, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur for his guidance and valuable suggestion during the research work and preparation of manuscript. I express my indebtedness, obedience and most hearty devotion and the authors are thankful to the Head, Department for providing the required research facilities.

### References

1. Ali, Prasad. Soil moisture studies in followed Barley rotation under mulches, antitranspirants and type of seed bed J Indian Soc. Soil Sci. 1975; 23(2):163-171.
2. Ali, Prasad R. Effect of mulch and type of seedbed on yield of barley grown on semi-arid condition. Annals of Arid Zone. 1974; 13(4):331-338.
3. Angrej Singh, Dhingra KK, Jagroop Singh, Singh MP, Singh A, Singh J. Effect of research sowing time and plant density on growth, yield and quality of Ethiopian mustard (*Brassica carinata* A.Br.). Journal of research, Punjab Agricultural University. 2002; 39(4):471-475.
4. Anonymous. Economic survey of Indian Agriculture, 2009-2010.
5. Anonymous. Agricultural production in U.P. Agriculture statistics and Crop Insurance, Uttar Pradesh Krishi Bhawan Lucknow, 2010, 4.
6. Awasthi UD, Dubey AP, Tripathi DK, Yadav PN, Tripathi AK, Kaushal Kumar, Mahesh Singh. Effect of sowing date and moisture conservation practice on growth and yield of Indian mustard (*Brassica juncea*) under scare moisture condition. Current Advances in Agricultural Science. 2009; 1(1):8-10.
7. Awasthi UD, Singh RB, Dubey SD. Effect of sowing date and moisture-conservation practice on growth and yield of Indian mustard (*Brassica juncea*) varieties. Indian Journal of Agronomy. 2007; 52(3):151-153.
8. Bhan S. Studies on suitable agronomic practices for rainfed brown sarson in U.P. Indian J. Agron. 1976; 21(3):271-276.
9. Bhan S. Water harvesting and moisture use conservation practices for dry farming of maize and mustard in U.P. annals of arid zone. 1979; 18(1&2):101-107.
10. Bhan S. Water use, yield and water use efficiency of mustard in relation to variety soil moisture and fertility under Gangatic alluvium of Utter Pradesh. Indian J. Agron. 1981; 26(1):62-65.
11. Bhan's S, Khan SA. Effect of frequency and method of irrigation of surface mulch on sunflower. Indian J Agron. 1980; 25(4):645-650.
12. Bishnoi KC, Singh K. Effect of sowing dates varieties and mulch on yield attributes of raya, Indian J Agron. 1979; 24(3):231-239.

13. Dauley HS, Singh RP, Singh KC. Effect of difference mulch on yield and moisture use of pearl millet. *Annals Arid Zone*. 1979; 18(1and2):108-115.
14. Fisher RA. *Statistical method for research workers* Ed. 10. Oliver and Boyd. Edinburgh, London, 1948.
15. Gouranga Kar, Ashwani Kumar, Martha M. Water use efficiency and crop coefficients of dry season oilseed crops. *Agricultural Water Management*. 2007; 87(1):73-82.
16. Gupta DK, Bhan S. Effect of in-situ moisture conservation and fertilization on yield, quality and economic of maize- mustard cropping system under conditions. *Indian J Soil Cons*. 1997; 25(2):133-135.
17. Kanaujia VK, Bhatia KS, Uttam SK. Response of mustard varieties to moisture conservation practice under rainfed condition. *Indian J Soil Cons*. 1996; 24(3):264-265.
18. Katiyar SC. Effect of moisture conservation practice on mustard production under rainfed condition. *Bharatiya Krishi Anusandhan Patrika*. 2002; 17:2-3, 81-86.
19. Katiyar SC. Water use and yield of rainfed mustard as influence by moisture conservation practices. *Indian J Soil Cons*. 2001; 29(2):182-183.
20. Majumdar DK, Sadhu AS. Effect of time sowing and fertilizers on the growth, development qualities characters and chemical composition of rapeseed (brown sarson), 1964.
21. Meena DS, Gupta AK. Effect of weed control measured and nitrogen on yield removal and nitrogen use efficiency of mustard. *Ann. Plant Soil Res*. 2001; 3(1):45:49.
22. Moitra R, Ghose DC, Sarkar S. Water use pattern and productivity of rainfed yellow sarson (*brassica napus L. var. Glauca*) in relation to tillage and mulching. *Soil and Tillage Res*. 1998; 38(1/2):153-160.
23. Panwar KS, Sharma SK, Nanwal RK. Influence of sowing times on the yield different mustard cultivars (*Brassica sp.*) under conserved soil moisture condition. *Indian Journal of Agriculture science*. 2000; 70(6):398-399.
24. Ramesh Kumar, Thakral NK, Kumar R. Influence of sowing dates on test weight, seed yield and oil content in *Brassica juncea*. *Cruciferae Newslatter*, 2002; 24:103-104.
25. Rathore AL, Pal AR, Sahu KK. Tillage and mulching effects on water use, root growth and yield of rainfed mustard and chickpea grown after low land rice. *J of the Science of Food and Agric*. 1998; 78(2):149-161.
26. Reddy N, Havangi GV, Hedge BRM, Munni K, Venugopal M, Viswasnath AP, Satyanarayana. Studies on in crop rotation of straw mulch on soil properties and yield of corn. *Agron. Abst*, 1978; (3-8):180.
27. Sachan SS, Shukla RK, Koshta SK. Root development, moisture extraction, water use and water use efficiency of linseed varieties in relation to row spacing and moisture conservation practices. *Indian J Soil Cons*. 1997; 25(2):128-132.
28. Sachan SS, Singh RK, Koshta SK. Effect of nitrogen level row spacing and moisture conservation practices rainfed mustard on eroded soil. *Indian J Soil Cons.*, 1997; 25(1):84-85.
29. Sachan SS, Singh RK, Koshta SK. Effect of nitrogen levels, row spacing and moisture conservation practices on rainfed mustard on eroded soil. *Indian J Soil Cons*. 1997; 25(1):84-85.
30. Sharma VD, Verma BS. Effect of nitrogen phosphorus and row spacing on yield, yield attributes and oil content of safflower under rainfed condition *Indian J Agron*. 1982; 27(1):28-23.
31. Shukla RK, tripathi RY, Uttam SK. Performance of toria in relation to moisture conservation practices and nitrogen levels under rainfed condition of central Uttar Pradesh. *Indian J. Soil Cons*. 1996; 24(2):137-140.
32. Singh SB, Chauhan YS, Maurya M L. Effect of kaoline cycocel and mulching on mustard diara land under rainfed condition of Eastern UP *Indian J Agron*. 1996; 34(4):471-472.
33. Singh SK, Singh G. Response of Indian mustard (*Brassica juncea*) varieties to nitrogen under varying sowing dates in Eastern Uttar Pradesh *Indian J Agron*. 2002; 42(2):242-248.
34. Suraj Bhan, Uttam SK, Tripathi RY. Yield, moisture use and root development of rainfed mustard as influenced by sowing methods and moisture conservation practice *Indian Journal of Soil Conservation*. 1997; 25(1):55-60.
35. Viets FG. Fertilizer and the efficient use of water, *Adv. Agron*. 1962; 253-264.
36. Yadav RN, Bhan S Uttam SK. Moisture use, yield and moisture use efficiency of mustard (*Brassica juncea L.*) in relation to moisture conservation practices and nitrogen levels under rainfed condition. *Indian J Soil Cons*. 1996; 24(3):221-225.
37. Yadav RN, Suraj Bhan, Uttam SK. Yield and moisture use efficiency of mustard in relation to sowing date, variety and spacing in rainfed lands of Central Uttar Pradesh. *Indian Journal of Soil Conservation*, 1994; 22 (3):29-32.