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# Effect of nutrient management, varieties and moisture conservation practices on yield attribute, yield and economics of barley (*Hordeum vulgare* L.) under rainfed condition

**Ravi Pratap Singh, SC Katiyar and Rajnish Kumar**

**Abstract**
A field experiment was conducted 2015-16 and 2016-2017 at experiment farm Soil Conservation of Water Management in C.S. Azad University of Agriculture and Technology, Kanpur. The experiment was carried out in factorial complete randomized block design with three replications and three nutrient management i.e. $N_1$ (100% RDN), $N_2$ (75% RDN through chemical fertilizers + 25% RDN through vermicompost) and $N_3$ (75% RDN through chemical fertilizers + 25% RDN through vermicompost + Azotobactor) and two varieties i.e. $V_1$-Narmada (K- 603), $V_2$-Azad (K-125) and three level of moisture conservation practices i.e. $M_1$ -Control, $M_2$ -Dust mulch created by weeding and hoeing followed by hand hoe after 25 days of sowing, $M_3$-Herbicide (2,4-D, 35 days after sowing) . Results of the experiments indicated grain yield that the 75% RDN through chemical fertilizers + 25% RDN through vermicompost + Azotobactor (26.61 q/ha) significantly superiority over all other nutrients management practices with Narmada (K-603) variety recorded grain yield (16.66 q/ha) > *Azad* (24.25 q/ha) among dust mulch created by weeding and hoeing followed by hand hoe produced highest grain yield (27.49 q/ha) of all over other moisture conservation practices and maximum net return 75% RDN through chemical fertilizers + 25% RDN through vermicompost + Azotobactor (19350 Rs./ha).

**Keywords:** Nutrient management, varieties, moisture conservation, yield, *Hordeum vulgare* L.

## Introduction
Many crop management factors affect the yield of this crop. It is grown in harsh environments, the potential for meeting growing demand by expanding the area sown is limited. Among the various management practices, the major non monetary inputs for enhancing the barley production is optimum time of sowing and optimum spacing which modifies the growth environment by way of regulating the natural endowments like light, temperature and moisture. Also owing to its hardy nature, it can be successfully cultivated in rainfed areas of Karnataka with appropriate land management practices. Criteria applied for selection of landform management depends on factors like rainfall of the region, soil type, field slope and intended crop for the season. There is a need for an improved *in-situ* soil and water conservation and proper drainage technology particularly in deep black soils that can protect the soil from erosion throughout the season and provide control at the place where the rain falls. Tillage, nitrogen levels and irrigation greatly influence the yield and malt quality of barley. Tillage methods have a major influence on aeration, moisture and temperature of soil which in turn affect the yield and quality of crop.

Nitrogen is a constituent of amino acids, required for proteins synthesis and other related compounds; it plays a role in almost all plant metabolic processes. It is an integral part of chlorophyll responsible for plant food manufacturing through photosynthesis. So it induces rapid growth, increases leaf size and improves quality, promotes fruit and seed development. Among the fertilizer nutrients, nitrogen is the nutrient that is absorbed in largest amount and is the most limiting factor for crop production (Dev and Chauhan 2009) [3]. The insufficient amount of nitrogen can reduce the quality below acceptable levels, while high nitrogen fertilizer rates can result in translocation of sufficient amount of nitrogen from vegetative organs to the grain, resulting in, high grain protein content.

A variety of any crop having good yield potential, resistance to insect-pest and disease sometimes becomes susceptible to such biotic factor and thus loses the yield potential. Over the time, they also start behaving differently to the applied nutrients. It is hence, desirable that varieties should be evaluated for staggered sowing and variable nutrients. Different varieties have different yield potential requiring variable nitrogen dose.

All the varieties may not be suitable for timely as well as the late sowing. The information on the suitability of barley varieties for different periods is not available as in the case of other crops, such as wheat**.**

Its grains contain 8-10 per cent protein and 74 per cent carbohydrates besides minerals and vitamin B-complex, it thus forms a staple food, cattle feed, malt for manufacturing of beer and other liquor products. Barley is also known to contain water soluble fiber (beta glucans) and oil compound (tocotrienols) which are found to be effective in lowering cholesterol level of blood.

This crop was grown on 6.71 lakhs hectares and recorded a production of 17.30 lakhs tonnes with an average yield of 2.58 t $ha^{-1}$ in India during 2013-14 (Anonymous 2014) [1]. The major barley producing states in India are Rajasthan, UP, Haryana, MP and Punjab. In Uttar Pradesh it was grown on 1.56 lakhs hectares with a production of 4.50 lakhs tonnes with an average yield of 2.88 t $ha^{-1}$ during 2013-14 (Anonymous 2014) [1]. Punjab ranked first in terms of productivity of barley during 2013-14. Due to its very hardy nature, barley can be successfully cultivated under adverse agro-climatic conditions. Barley is usually preferred crop by farmers over wheat under constrained environment (Mishra and Shivakumar, 2002) [5].

About 75 per cent of world barley is used for animal feed and 20 per cent for malting, with the remaining 5 per cent for direct food use. In recent years the use of barley as food has gained momentum, especially in North America and Europe, gaining the label as a 'functional' food. Almost 60 per cent of the total barley produced in India is consumed as cattle feed. Barley requires cool weather during early growth and warm and dry weather at maturity. It is grown by nearly 100 countries on about 56 million hectares.The utilization of barley for malting and brewing industry has picked up recently with an increase of consumption of beer and other malt based products in many countries including India. Presently about 25-30 per cent of the total barley production is used in the manufacture of malt and malt extract, which is further utilized for brewing, distillation, baby foods, cocoa-malt drinks and medicinal syrups.

## Materials and methods

The present investigation was conducted at Soil Conservation and Water Management Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during *rabi* season of 2015-16 and 2016-17. The experimental farm falls under the Indo-gangetic alluvial tract of Central Uttar Pradesh.

Geographically, Kanpur is situated in the central part of U.P. and subtropical tract of North India between latitude ranging from $25^0$ 56' to $28^0$ 58' North and longitude $79^0$ 31' to $80^0$ 34' East and is located on an elevation of about 125.9 meters above mean sea level in gangetic plain. The seasonal rainfall of about 816 mm received mostly from $II^{nd}$ fortnight of June or first fortnight of July to mid October with a few showers in winter season.

The experiment was carried out in factorial complete randomized block design with three replications and three nutrient management i.e. $N_1$ (100% RDN), $N_2$ (75% RDN through chemical fertilizers + 25% RDN through vermicompost) and $N_3$ (75% RDN through chemical fertilizers + 25% RDN through vermicompost + Azotobactor) and two varieties i.e. $V_1$-Narmada (K- 603), $V_2$-Azad (K-125) and three level of moisture conservation practices i.e. $M_1$ - Control, $M_2$ -Dust mulch created by weeding and hoeing followed by hand hoe after 25 days of sowing, $M_3$-Herbicide (2,4-D, 35 days after sowing)

## Results and Discussion

### Yield attributes

### Ear length (cm)

The results that the nutrient management with 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter produced longest ear than all other tested nutrients management practices in both the years of investigation. The pooled results of two years also indicated the supremacy of the 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter, which was statistically more effective in producing longest ear. The *narmada* cultivar of barley produced highest ear in both years of investigation in comparison to *azad*. The pooled results of two years also displayed the superiority of cultivar *Narmada* over genotype *Azad*. In moisture conservation practices dust mulching produced longest ear during two years of study over all other tested practices of moisture conservation. control practice of moisture conservation produced shortest ear during both the years as well as in pooled results. These results are in accordance to the findings of Shantveerayya *et al.* (2015) [6] and Awasthi *et al.* (2017) [2].

### Spikelets/spike

The perusal of the data make it clear that the 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter displayed maximum spikelets per spike during both the year of study in comparison to other two tested nutrient management practices. The pooled results also indicated that 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter having maximum spikelets per spike which was superior to other nutrients management practices. The highest number of spikelets/spike was also counted under cultivar *Narmada*, while lowest spikelets/spike was noted under cultivar *Azad* in both the year of study. Pooled results were also found in favour of cultivar *Narmada*.

In case of moisture conservation practices dust mulching maintained the highest spikelets/spike in both the years and also in pooled results of two experimental seasons, where it was found superior to all other moisture conservation practices. The lowest spikelets/spike was counted in control of moisture conservation practices in both the years of study and pooled results of two years. The difference in spikelets/spike have also been reported by ET- Toukhy and Abdel-Azeem (2000) [4].

### Number of grains/spike

It is obvious that 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter maintained the highest number of grains/spike in both the years and also in pooled results of two experimental seasons, where this was found much superior over other two nutrients management treatments. In pooled results of two years the 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter displayed significantly higher number of grains per spike over other two tested nutrients management practices. between the varieties, cultivar *Narmada* produced higher grains/spike over the genotype *Azad* in both the experimental years and also pooled results of two years.

In case of moisture conservation practices, dust mulching maintained the highest grains/spike in two experimental season and also in pooled results of two years, where it was found much superior to all other moisture conservation practices. The lowest number of grains/spike was counted at control in both the years of study and pooled results of two years. The other research worker like Shantveerayya *et al.* (2015) [6] and Awasthi *et al.* (2017) [2] have also reported the similar results.

**1000-grain weight (g)**

The results displayed that 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter maintained the highest weight of 1000-grain in both years and in pooled results of two experimental season, where this was found superior to other two tested practices i.e., 75% RDN through chemical fertilizer + 25% RDN through vermicompost and 100% RDN through chemical fertilizer. The minimum test weight (1000-grain) was weighed in 75% RDN through chemical fertilizers + 25% RDN through vermicompost in two experimental years and pooled results of two years.

Cultivar *Narmada* showed the superiority as compared to *Azad* during two experimental years. The pooled results of two years was also found in favour of genotype *Narmada*. But statistically analysed value of test weight showed at par under both cultivars.

The maximum weight of 1000-grain was also noted under dust mulching closely followed by herbicide, moisture conservation practice and lowest 1000-grain weight in control. The dust mulching exhibited significantly higher 1000-grain weight as compared to control practice of moisture management in pooled results of two year. These results are in concordant to the findings of Shantveerayya *et al.* (2015) [6] and Awasthi *et al.* (2017) [2].

**Yield**

**Grain yield (q/ha)**

It is clear from the results given in (table 3) that the 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter gave highest grain yield, which was higher than all other nutrients management practices in both the years of study. The pooled results of two years under 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter established its significantly superiority over all other nutrients management practices. Therefore, the order of performance of nutrients management practices 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter was (26.61 q/ha), 75% RDN through chemical fertilizer + 25% RDN through vermicompost (25.73 q/ha) > (24.04 q/ha) 100% RDN through chemical fertilizer. 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter treatment 10.70 per cent more grain yield over 100% RDN through chemical fertilizer. Under tested varieties, cultivar *Narmada* (K-603) produced significantly highest grain yield as compared to *Azad (K-125)* in both the experimental seasons and in pooled results of two years. Therefore, the order of performance of varieties was *Narmada* (16.66 q/ha) > *Azad* (24.25 q/ha). The 9.94 per cent more yield obtained from cultivar *Narmada* over *Azad*.

Among the moisture conservation practices, dust mulching gave significantly highest grain yield in both the experimental seasons and in pooled results of two years. The order of moisture conservation practices was dust mulching (27.49 q/ha) > herbicide (25.76 q/ha) > control (23.00 q/ha). The dust mulching gave 6.72 per cent and 19.52 per cent more yield over herbicide and control moisture conservation practices, respectively. These results confirm the findings of Solanki *et al.* (1987) [7] and Tiwari *et al.* (2008) [8].

**Straw yield (q/ha)**

It is clear from the results that (Table 3)the significantly highest straw yield was noted in 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobacter over other two nutrients management practices in both the years. The trend of results in pooled data was also in favour of chemical. The minimum straw yield was weighed in 100% RDN through fertilizer in both the experimental seasons and in pooled results of two years.

The cultivar *Namrada* produced significantly higher straw yield as compared to *Azad* in both the years and pooled results of two years. The minimum straw yield was weighed under tested cv. *Azad* during two years of experimentation and pooled results of two years.

Perusal of data make it clear that dust mulching gave higher straw yield by 38.37 q/ha over other two tested moisture conservation practices. The minimum straw yield was recorded under control.

**Economics**

**Cost of cultivation**

The cost of cultivation was worked out by 75% RDN through chemical fertilizer + 25% RDN through vermicompost (Rs 28503/ha) which was lowest and followed by 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter* (Rs.28554/ha). The highest cost of cultivation was computed Rs. 29003/ha under 100% RDN through chemical fertilizer.

Slightly difference was worked out under tested variety of barley. Under moisture conservation practices the maximum cost of cultivation was worked out by Rs. 29609/ha under dust mulching followed by herbicide use treatment (Rs. 28513/ha). Control treatment was required minimum amount for moisture conservation (Rs. 27738/ha).

**Gross return (Rs/ha)**

The gross income was found highest (Rs 47404/ha) under 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter* and least was found in 75% RDN through chemical fertilizer + 25% RDN through vermicompost (Rs. 43882/ha).

**Net return (Rs/ha)**

The net return was found maximum Rs 19350/ha under 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter*. The minimum net return was recorded Rs.15373 in 100% RDN through chemical fertilizer and at par net return was recorded Rs. 15380/ha in 75% RDN through chemical fertilizer + 25% RDN through vermicompost.

Variety *Narmada* gave higher net return Rs. 15872/ha, while variety *Azad* gave minimum net return of Rs 15530/ha in pooled results of two years.

Dust mulching practice of moisture conservation gave net income of Rs 19324/ha, which was highest in comparison to other tested practices of moisture conservation. The minimum net return was recorded by Rs 13636/ha under control treatment in pooled results of two years. These results are in agreement with those reported by Awasthi *et al.* (2017) [2].

**Benefit cost ratio (Rs/ha)**

It is interesting to make that 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter* worked out the maximum benefit cost ratio of 1:1.68. The lowest benefit cost ratio 1:1.52 was computed under in 100% RDN through chemical fertilizer pooled results of two years. The maximum benefit cost ratio of 1:1.61 was computed under test variety *Narmada*, while lowest was noted in variety *Azad* in pooled results of two years.

Under moisture conservation practices dust mulching brought out the maximum benefit cost ratio of 1:1.65, while lowest noted under control (1:1.49) in pooled results of two years.

**Table 1:** Effect of different treatments on ear length and spikelets/spike

| Treatments | Ear length (cm) | | | Spikelets/spike | | |
|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled |
| **A. Nutrient management** | | | | | | |
| $N_1$- 100% RDN through chemical fertilize | 7.11 | 7.26 | 7.18 | 14.10 | 14.44 | 14.27 |
| $N_2$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost | 7.26 | 7.38 | 7.32 | 15.16 | 15.49 | 15.32 |
| $N_3$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobactor | 7.83 | 7.96 | 7.89 | 16.30 | 16.66 | 16.48 |
| S.E. (d±) | 0.12 | 0.13 | 0.09 | 0.33 | 0.33 | 0.23 |
| C.D. 5% | 0.27 | 0.30 | 0.18 | 0.74 | 0.74 | 0.47 |
| **B. Varieties** | | | | | | |
| $V_1$- *Narmada* (K- 603) | 7.51 | 7.64 | 7.57 | 15.25 | 15.59 | 15.42 |
| $V_2$- *Azad* (K- 125) | 7.30 | 7.43 | 7.36 | 15.14 | 15.47 | 15.30 |
| S.E. (d±) | 0.09 | 0.11 | 0.07 | 0.27 | 0.27 | 0.19 |
| C.D. 5% | 0.22 | N.S. | 0.14 | N.S. | N.S. | N.S. |
| **C. Moisture conservation practices** | | | | | | |
| $M_1$-Control | 7.18 | 7.31 | 7.24 | 13.83 | 14.16 | 13.99 |
| $M_2$-Dust mulching | 7.68 | 7.80 | 7.74 | 16.66 | 16.99 | 16.82 |
| $M_3$-Herbicide | 7.35 | 7.50 | 7.42 | 15.10 | 15.44 | 15.27 |
| S.E. (d±) | .12 | 0.13 | 0.09 | 0.33 | 0.33 | 0.23 |
| C.D. 5% | 0.27 | 0.30 | 0.18 | 0.74 | 0.74 | 0.47 |

**Table 2:** Effect of different treatments on number of grain/spike and 1000-grain weight (g)

| Treatments | Grains/spike | | | 1000-grain weight (g) | | |
|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled |
| **A. Nutrient management** | | | | | | |
| $N_1$-100% RDN through chemical fertilize | 36.10 | 35.60 | 35.85 | 35.13 | 35.23 | 35.21 |
| $N_2$-75% RDN through chemical fertilizer + 25% RDN through vermicompost | 36.88 | 37.22 | 37.05 | 35.16 | 35.29 | 35.22 |
| $N_3$-75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobactor | 39.49 | 39.83 | 39.66 | 35.24 | 35.44 | 35.34 |
| S.E. (d±) | 0.63 | 0.72 | 0.47 | 0.64 | 0.62 | 0.45 |
| C.D. 5% | 1.40 | 1.60 | 0.95 | 1.43 | 1.39 | 0.89 |
| **B. Varieties** | | | | | | |
| $V_1$-*Narmada* (K- 603) | 38.14 | 37.92 | 38.02 | 35.32 | 35.37 | 35.34 |
| $V_2$-*Azad* (K- 125) | 36.84 | 37.18 | 37.01 | 35.18 | 35.27 | 35.22 |
| S.E. (d±) | 0.51 | 0.58 | 0.39 | 0.52 | 0.51 | 0.36 |
| C.D. 5% | 1.15 | N.S. | 0.78 | N.S. | N.S. | N.S. |
| **C. Moisture conservation practices** | | | | | | |
| $M_1$-Control | 36.05 | 35.55 | 35.80 | 34.12 | 34.16 | 34.14 |
| $M_2$-Dust mulching | 39.55 | 39.88 | 39.71 | 36.56 | 36.64 | 36.60 |
| $M_3$-Herbicide | 36.88 | 37.22 | 37.05 | 35.08 | 35.16 | 35.12 |
| S.E. (d±) | 0.63 | 0.72 | 0.47 | 0.64 | 0.62 | 0.45 |
| C.D. 5% | 1.40 | 1.60 | 0.95 | 1.43 | 1.39 | 0.89 |

**Table 3:** Effect of different treatments on grain and straw yield (q/ha) of barley

| Treatment | Grain yield (q/ha) | | | Straw yield (q/ha) | | |
|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled |
| **A. Nutrient management** | | | | | | |
| $N_1$- 100% RDN through chemical fertilize | 23.15 | 24.94 | 24.04 | 33.69 | 33.90 | 33.79 |
| $N_2$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost | 24.68 | 26.79 | 25.73 | 35.20 | 36.07 | 35.63 |
| $N_3$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobactor | 25.82 | 27.40 | 26.61 | 37.23 | 37.99 | 37.61 |
| S.E. (d±) | 0.83 | 0.96 | 0.63 | 1.09 | 1.20 | 0.87 |
| C.D. 5% | 1.70 | 1.93 | 1.26 | 2.20 | 2.43 | 1.74 |
| **B. Varieties** | | | | | | |
| $V_1$- *Narmada* (K- 603) | 25.45 | 27.88 | 26.66 | 36.63 | 37.70 | 37.16 |
| $V_2$- *Azad* (K- 125) | 23.65 | 24.86 | 24.25 | 34.24 | 34.27 | 34.25 |
| S.E. (d±) | 0.68 | 0.78 | 0.51 | 0.89 | 0.98 | 0.71 |
| C.D. 5% | 1.38 | 1.58 | 1.02 | 1.80 | 1.99 | 1.42 |
| **C. Moisture conservation practices** | | | | | | |
| $M_1$-Control | 22.82 | 23.18 | 23.00 | 22.74 | 32.48 | 33.11 |
| $M_2$-Dust mulching | 26.44 | 28.55 | 27.49 | 37.89 | 38.86 | 38.37 |
| $M_3$-Herbicide | 24.39 | 27.14 | 25.76 | 85.07 | 36.62 | 35.88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| S.E. (d±) | 0.83 | 0.96 | 0.63 | 1.09 | 1.20 | 0.87 |
| C.D. 5% | 1.70 | 1.93 | 1.26 | 2.20 | 2.43 | 1.74 |

**Table 4:** Effect of nutrient management, varieties and moisture conservation practices on cost of cultivation (Rs/ha), gross return (Rs/ha), net profit (Rs/ha) and BCR of barley

| Treatment | Cost of cultivation (rs/ha) | | | Gross return (rs/ha) | | | Net return (rs/ha) | | | BCR | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled | 2015-16 | 2016-17 | Pooled |
| **A. Nutrient management** | | | | | | | | | | | | |
| $N_1$- 100% RDN through chemical fertilizer | 28398 | 29608 | 29003 | 41302 | 47449 | 44376 | 12904 | 17842 | 15373 | 1:1.45 | 1:1.59 | 1:1.52 |
| $N_2$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost | 27441 | 29108 | 28503 | 43105 | 44659 | 43882 | 15207 | 15552 | 15380 | 1:1.54 | 1:1.53 | 1:1.53 |
| $N_3$- 75% RDN through chemical fertilizer + 25% RDN through vermicompost + Azotobactor | 27898 | 28666 | 28554 | 43201 | 51606 | 47404 | 15760 | 22940 | 19350 | 1:1.57 | 1:1.79 | 1:1.68 |
| **B. Varieties** | | | | | | | | | | | | |
| $V_1$- *Narmada* (K- 603) | 27972 | 29267 | 28620 | 43554 | 49428 | 46491 | 15582 | 20161 | 15872 | 1:1.55 | 1:1.68 | 1:1.61 |
| $V_2$- *Azad* (K- 125) | 27852 | 28987 | 28420 | 41517 | 46382 | 43950 | 13665 | 17395 | 15530 | 1:1.49 | 1:1.59 | 1:1.54 |
| **C. Moisture conservation practices** | | | | | | | | | | | | |
| $M_1$-Control | 26876 | 27999 | 27738 | 39809 | 42337 | 41073 | 12933 | 14338 | 13636 | 1:1.48 | 1:1.51 | 1:1.49 |
| $M_2$-Dust mulching | 28964 | 30253 | 29609 | 45811 | 52054 | 48933 | 16847 | 21801 | 19324 | 1:1.58 | 1:1.72 | 1:1.65 |
| $M_3$-Herbicide | 27897 | 29129 | 28513 | 41988 | 49325 | 45657 | 14091 | 20196 | 17144 | 1:1.50 | 1:1.69 | 1:1.59 |

## Conclusion

On the basis of two years field investigation made during *Rabi* season of 2015-16 and 2016-17 at Soil Conservation and Water Management Farm. C.S. Azad university of Agriculture and technology, Kanpur. The experiments indicated that the 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter* maximum net returned (Rs. 19350/ ha) with barley variety Narmada (K-603)" and dust mulch created by weeding and hoeing followed by hand proved better than all other treatments. BCR were maximum (1:1.68) found in 75% RDN through chemical fertilizer + 25% RDN through vermicompost + *Azotobacter*.

## Reference


1. Anonymous. Economics survey of India, 2013-14.
2. Awasthi UD, Singh SP, Mishra PK, Prajapati B, Singh A. Productivity and profitability of rainfed barley (*Hordium vulgare*) crop as influenced by variety, fertility and moisture conservation. Int. J Microbio. App. Sci., 2017; 6(6):2952-2957.
3. Dev D, Chauhan RS. Effect of sowing dates and nitrogen levels on growth and yield of barley (Hordeum vulgare L.).P rog Agric., 2009; 9:295-97.
4. El-Toukhy SA, Abdel-Azeem HH. Response of barley (*Hordeum vulgare*) to biofertilization technology. Annals of Agricultural Science (Cairo), 2000; 2:539-559.
5. Mishra BN, Shivakumar. barley. In: Techniques and management of field crop production, Agrobios, India, 2002, 478.
6. Shantveerayya, Mansure CP, Alagundagi SC, Salakinkop SR. Productivity of barley (*Hordium vulgare* L.) genotypes to integrated nutrient management and broad bed and furrow method of cultivation in watershed area. International Journal of Agriculture Science, 2015; 7(4):497-501.
7. Solanki NS, Singh RR, Chauhan RS. Effect of nitrogen, agro-chemicals and Azotobacter inoculation with and without FYM on yield and quality of rainfed barley. Indian Journal of Agricultural Research, 1987; 21(2):83-87.
8. Tiwari DD, Katiyar NK, Nigam RC, Gupta BR. Yield, nutrient uptake and quality characteristics of barley (*Hordeum vulgare* L.) as affected by graded levels of nitrogen and Azotobacter inoculation. Research on Crops. 2008; 9(2):243-245.