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# Effect of moisture conservation practices and row spacing on economy of maize (*Zea mays* L.) varieties under rainfed condition

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**Abstract**
An experiment was carryout during *kharif*, 2011 at Soil Conservation and Water Management Farm of C.S. Azad University of Agriculture and Technology, Kanpur, to find out the "Effect of moisture conservation practices and row spacing on economy of maize (*Zea mays* L.) varieties under rainfed condition". This experiment was comprised 12 combinations of 2 varieties of maize, 2 row spacing's and 3 moisture conservation practices. All 12 treatment combinations were tested in Factorial Randomized Block Design with three replications. The variety 'Azad Uttam' (32237 Rs/ha, 13159 Rs/ha and 1:1.59), row spacing of 45cm (30933 Rs/ha, 11520 Rs/ha and 1:1.59) and moisture conservation practices of ridging and furrowing method (33235 Rs/ha, 13220 Rs/ha and 1: 1.66) recorded maximum values of gross return, net return and cost: benefit ratio compare other treatments.

**Keywords:** economy, moisture conservation, row spacing and varieties.

## Introduction
Maize (*Zea mays* L.) is more widely grown over the Indian subcontinent than any other cereal suggesting that it has an exceptionally wide adaptability. Each climate zone has its characteristic hybrids, composites and local varieties, maturing in 60-150 days. Different strains of maize shown remarkable adaptability to varied climatic and management factors. The crop is grown generally under rainfed during *Kharif* season and water stress at early growth stages results in an elongation of roots which ultimately induced drought resistance in plants. The consumptive use of water by maize ranges between 400-600 mm with about 2.5-4.5 mm/day. Water logging is highly detrimental for the crop particularly the knee height and grain filling stages are most sensitive for excess water. Water logging for more than 3 or 4 days may result in a yield reduction to the extent of 50 per cent or even in sometimes total crop failure depending upon severity of water logging. However, such situation may be averted by growing crop on ridges in poorly drained fields.

Rainfed areas (In India, 67 per cent of total cropped area) are characterized by erratic rainfall and soils with low productivity/soil fertility and organic matter. There is continuing degradation by way of soil erosion, nutrients depletion and runoff losses, which amount to about 50 per cent of total annual rainfall received in the country. Noticeably, these losses result in low crop yields. Soil erosion leads to many losses.

Crop geometry and plant population in maize crop help great in conserving soil and soil moisture both under rainfed condition. Besides, they play an important role in intercepting sunlight for photosynthesis and thereby crop yields. Plant population may vary from variety to variety according to plant structure and growing habit. Thus optimum plant population in proper geometry is essential to harvest better crop yields of a given variety along with conservation of soil and other production resources. Advantages of plant geometry manipulation in maize on crop production and conservation of resources during *Kharif* rainfed season (Bharadwaj *et al.*, 1980) [2].

Mechanical measures are also helpful in conserving soil and moisture under rainfed situation. Planting of maize on ridges and furrows between the rows controls soil erosion, run-off and increases crop yields. The ridging and furrowing after crop establishment has been found useful even on flat lands, as the practice is helpful to save the crop both during drought as well as wet season. Furrows provide more opportunity and time to runoff water to soak into the soil while the ridges provide adequate aeration to the crop during water inundation or flooding. In various experiments conducted at Kanpur on light textured soil, furrowing in between the rows of crop like maize, jowar, bajra, cotton etc. after establishment followed by shaping the ridges manually brought about substantial increase in yield. Sachan *et al.* (1999) [8] reported that

ridging and furrowing between the crop rows 25 days after sowing increased yield attributes, yield and nitrogen uptake as compared to flat seed beds. Losses caused by weeds are more during early stage than in later stages. Mechanical weeding is good for root aeration but continuous rains during *kharif* season pose a serious problem in which the soil becomes wet and any agricultural operation cannot be done. Under such conditions the weeds grow very luxuriantly and they do permanent harm to the crop before they are controlled. Therefore, herbicidal weed control may prove a better alternative for taking care of weed from initial stage of growth. Herbicides are getting popularity because of their easiness in application, less time consuming at one hand and economical on the other hand.

## Materials and Methods

A field experiment was conducted at Soil Conservation and Water Management Farm, C.S. Azad University of Agriculture and technology, Kanpur (U.P.) during *kharif* 2011. The experimental soil was having 30.4% sand, 32.4% silt and 35.6% clay with 0.62% organic carbon, 236 kg/ha available N, 18.5 kg/ha available P and 352 kg/ha available K and electrical conductivity 0.29 ds/m in the year of experiment. The total rainfall received during the crop season was 645.8 mm distributed in 37 rainy days. The treatments comprised 12 combinations of 2 varieties of maize, 2 row spacing's and 3 moisture conservation practices. All treatments were allocated to different plots randomly in each replication. A uniform dose of 80 kg N + 40 kg $P_2O_5$ + 40 kg $K_2O$/ha was given through Urea, Diammonium phosphate and Muriate of potash, respectively. Half of total N and full dose of P and K were applied through band placement 2-3 cm below the seed with the help of funnel attached with *Deshi* plough used for seed sowing. Remaining half dose of N was topdressed at 20 days after sowing in standing crop. Sowing of maize varieties was done on July 12, 2011 in furrows behind *Deshi* plough deploying seed @ 25 kg and 18.75 kg/ha in 45 and 60 cm row spacing's, respectively. In the treatment plots of weeding and hoeing, one hand weeding and hoeing was done with the help of *khurpi* at 20 DAS to conserve moisture and check the growth of weeds.

## Result and Discussion

### Cost of cultivation

It is clear from the table-1.0 that cost of cultivation was exactly the same for two test varieties of maize. However, row spacing of 45 cm required higher cost than 60cm spacing by Rs 670/ha. Among moisture conservation practices, ridging and furrowing recorded highest cultivation cost (Rs 20015/ha) which was found Rs 510 and 2300/ha of higher than the cost under hand weeding and hoeing and atrazine, respectively. Higher cultivation cost under 45 cm row spacing was associated with more seed rate sown under this spacing, while under ridging and furrowing, higher cultivation cost was associated with higher cost of labour engaged in ridging formation. Lowest cost under atrazine treatment was due to minimum cost of herbicide and its application.

### Gross return

Gross return was worked out higher in variety 'Azad Uttam' than 'Azad Kamal' by the margin of Rs 4471/ha. The 45 cm row spacing recorded Rs 1873/ha higher gross return than wider row spacing of 60 cm. Among moisture conservation practices, ridging and furrowing recorded maximum gross return of Rs 33235/ha which was found Rs 4273 and 5433/ha higher than the gross return values under one weeding and hoeing by *khurpi* and Atrazine treatments, respectively.

### Net return

Variety 'Azad Uttam' earned Rs 13159/ha net return which was higher over net return of variety 'Azad Kamal' by the margin of Rs 4471/ha. Out of two row spacings, 45 cm spacing earned Rs 11520/ha net return and it was found Rs 1203/ha higher than the net return under 60 cm spacing. Among moisture conservation practices, ridging and furrowing recorded highest net return of Rs 13220/ha which was found to be Rs 3763 and 3133/ha higher than the net return with one weeding and hoeing by *khurpi* and Atrazine, respectively.

### Cost: benefit ratio

Variety 'Azad Uttam" recorded 1:1.69 cost % benefit ratio which was higher than variety 'Azad Kamal'. Out of different moisture conservation practices, ridging and furrowing treatment recorded highest of 1:1.66 cost: benefit ratio followed by Atrazine and one weeding and hoeing by *khurpi*.

Gross return, net return and cost: benefit ratio were recorded higher in variety 'Azad Uttam' than 'Azad Kamal'. These might be attributed to higher grain and stover yields of variety 'Azad Uttam'. As the cost of cultivation was exactly same in both varieties, higher yields of 'Azad Uttam' are responsible for higher economic parameters than other variety 'Azad Kamal'. It confirms the finding of Pal and Bhatnagar (2009) [4].

45 cm row spacing registered higher net return than 60 cm row spacing. It might be attributed to gross return which was numerically higher under 45 cm row spacing than 60 cm wider rows. Though, cost of cultivation was also higher under 45 cm row spacing, but margin of increase was higher in gross return which could not only compensated the cost but increased net return over 60 cm row spacing. These results are in accordance to the findings of Pandey *et al.* (2002) [5] and Kumar (2008) [3].

Treatment of ridging and furrowing exhibited the highest gross return, net return and cost : benefit ratio. This moisture conservation practice exhibited the higher grain and stover yields as a result the highest economic viability being observed as compared to atrazine (pre-emergence) and one weeding and hoeing and by *khurpi* treatments. The lowest gross return was observed under Atrazine treatment. Sachan and Gangwar (1996) [7] also observed that the earthing prevailed better in respect of net return of maize over control under rainfed condition. Pandey *et al.* (2001) [6] also found that earthing of the crop proved most effective followed by hand weeding and paraquat. These results are in accordance to the findings of Uttam *et al.* (2007) [9] and Arulkumar *et al.* (2008) [1].

**Table 1:** Effect of deferent treatments on cost of cultivation (Rs/ha), gross return (Rs/ha), net return (Rs/ha) and cost: benefit ratio.

| Treatment | Cost of cultivation (Rs/ha) | | | Gross return (Rs/ha) | | | Net return (Rs/ha) | Cost : benefit ratio |
|---|---|---|---|---|---|---|---|---|
| | Common | Variable | Total | By grain | By stover | Total | | |
| **Varieties** | | | | | | | | |
| Azad Uttam | 15100 | 3978 | 19078 | 24820 | 7417 | 32237 | 13159 | 1 : 1.59 |
| Azad Kamal | 15100 | 3978 | 19078 | 23750 | 21350 | 27766 | 8688 | 1 : 1.46 |
| **Row spacings- cm** | | | | | | | | |
| 45 | 15100 | 4315 | 19413 | 22390 | 7143 | 30933 | 11520 | 1 : 1.59 |
| 60 | 15100 | 3643 | 18743 | 22370 | 6690 | 29060 | 10317 | 1 : 1.55 |
| **Moisture conservation practices** | | | | | | | | |
| One weeding and hoeing by khurpi | 15100 | 4405 | 19505 | 22250 | 6712 | 28962 | 9457 | 1 : 1.48 |
| Ridging and furrowing | 15100 | 4915 | 20015 | 25630 | 7605 | 33235 | 13220 | 1 : 1.66 |
| Atrazine (pre-emergece) | 15100 | 2615 | 17715 | 21370 | 6432 | 27802 | 10087 | 1 : 1.57 |

Sale market price, maize grain @ Rs 1000/q and maize stover @ Rs 100/q

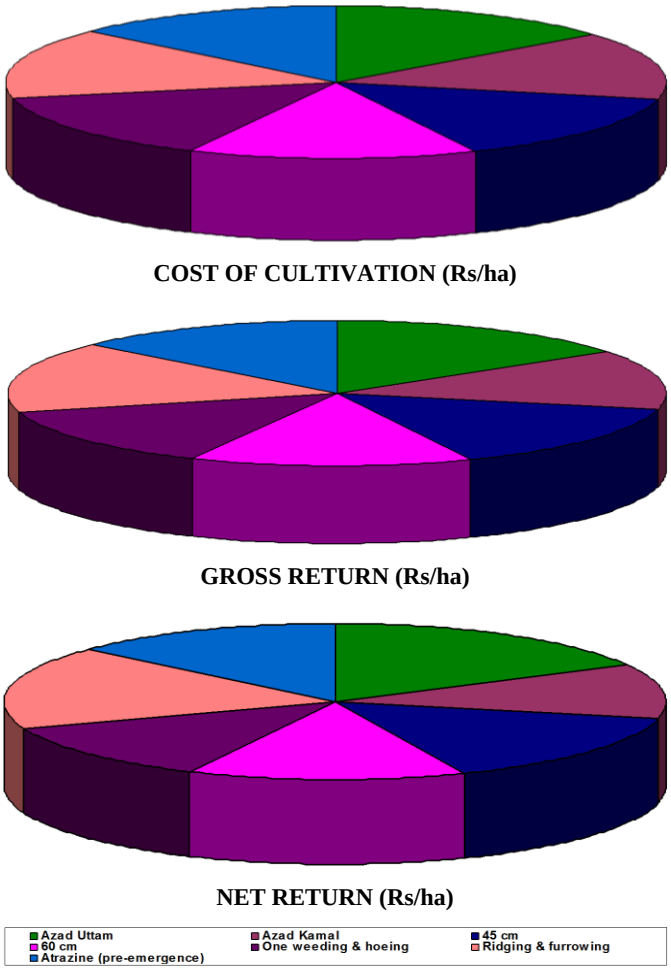


**Fig 8:** Effect of different treatments on economics (Rs/ha)

## Conclusion

The results of present study may be concluded the treatments of variety 'Azad Uttam', row spacing 45 cm and ridging and furrowing practice proved to be the most economically viable in rainfed maize crop under central Uttar Pradesh.

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