

Intercropping of chickpea and Indian mustard for resource conservation and production in Bundelkhand region in Central India

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Intercropping of chickpea and Indian mustard (8:1) in terms of chickpea equivalent yield for both crops (chickpea + Indian mustard) revealed that total production and net returns were observed higher with intercropping over sole cropping of chickpea in Bundelkhand region in Central. The water use efficiency also increased under intercropping over sole cropping of chickpea.

Key words: Intercropping, Resource conservation, Sustainable crop

SUSTAINABLE crop production is very important particularly in Bundelkhand region which has undulating terrain, scare vegetation cover, hostile climate and unfavorable edaphic conditions. Bundelkhand region comprises 13 districts, covering 6 districts of Madhya Pradesh (Datia, Damoh, Chhatarpur, Panna, Sagar and Tikamgarh) and 7 districts of Uttar Pradesh (Jhansi, Jalaun, Hamirpur, Lalitpur, Mahoba, Chitrakoot and Banda) in Central India, having an area of 7.07 million ha. In this region, chickpea is usually grown in pure stand under rainfed condition during *rabi* season and many times it fails due to infestation of wilt and attack of pod borer and cause considerable losses to the farmers. However, a combination of chickpea along with a drought resistant oilseed crop such as Indian mustard in a suitable inter cropping system can be practiced for better resource conservation and enhancing production. In order to overcome the risk of total crop failure and to enhance the productivity as well as net profit per unit area and per unit time besides increasing the water use efficiency, intercropping cropping of Indian mustard in chickpea can be practiced. Growing of Indian

mustard as an intercrop in chickpea provides better surface cover, conserve and utilizes soil moisture uniformly and efficiently, and assures production of at least one crop in the event of infestation of wilt and attack of pod borer in sole cropping of chickpea. Package of practices for intercropping of chickpea + Indian mustard have been given below:

Package of practices

Field preparation

Usually chickpea is grown on conserved soil moisture under rainfed condition, if moisture is found insufficient in the soil for proper germination then field should be prepared after a pre-sowing irrigation to ensure good germination of crops. The soil chosen for its cultivation should be free from excessive soluble salt and nearly neutral in reaction.



However, soils having a pH higher than 8.5 are not suitable for its cultivation.

Varieties

Chickpea variety such as 'JG 315', 'JG 322', 'JG 16', and 'JG 130' are suited for the region. Indian mustard variety such as 'Pusa Bold', 'Varuna' and 'Pusa Jai Kisan' are suitable for cultivation in the region.

Sowing time

Optimum time for sowing of both crops, chickpea and Indian mustard, in mixed cropping system is between 15 October to 15 November.

Seed rate and spacing

The seed of chickpea should be treated with Carboxin (Vitavax) @ 2 g and *Tricoderma viridi* @ 4 g/kg of seed followed by *Rhizobium* and PSB



Fig. 1. Chickpea and Indian mustard intercropping (8:1)

Table 1. Productivity and water use efficiency under chickpea + Indian mustard intercropping

Treatment	Seed yield (kg/ha)	Chickpea equivalent yield (kg/ha)	Water-use-efficiency (kg/ha-mm)
Sole chickpea	1,657	1,657	9.81
Chickpea + Indian mustard intercropping (8:1)		1,920	11.71
Chickpea	1,590		
Indian mustard	566		

culture each @ 5 g/kg seed. The seed of Indian mustard should be treated with Thiram @ 3 g/kg of seed. Sowing should be done in rows on contours. Sowing of chickpea and Indian mustard is done in 8:1 ratio. Row to row spacing is kept 30 cm for chickpea. After eight row of chickpea one row of Indian mustard is sown as inter crop. For this 70 kg seed of chickpea and about 1 kg seed of Indian mustard per hectare is required.

Application of fertilizers

Apply 15-20 kg N, 40-50 kg P₂O₅ per hectare as basal dose, which could be fulfilled by basal application of 100 kg di-ammonium sulphate (DAP) per hectare.

Weed control

One manual weeding at 25-30 days after sowing control weeds effectively. Weeds can also be controlled chemically by applying pre-emergence spray of Pendimethalin @ 1.0 litre a.i. in 500-600 litre water per hectare as pre-emergence spray.

Water management

The crops respond to irrigation, particularly around 45 days after sowing and at the early pod filling stage (around 110 days after sowing). If winter rain fails and frost occurs, give one irrigation of 5 cm at pre-flowering stage and one at pod development stage. In no case first irrigation should be given earlier than four weeks after sowing. A light irrigation should be given because heavy irrigation is always harmful to chickpea.

Plant protection

Insects

Cutworm of chickpea: It is serious pest of chickpea. The pest is sporadic in nature and can be controlled by the application of 4% Endosulfan dust or Lindane 6% granules at the rate of 20-25 kg per hectare mixed in the soil at the sowing time.

Chickpea pod borer: This is the most serious pest of chickpea and cause considerable yield loss. Spray Monocrotophos 40 ec 800 ml or 1.25 litre Endosulfan 35 ec by dissolving in 600-800 litre of water per hectare.

Aphid in Indian mustard: It is a very serious pest and the main limiting factor in the production of Indian mustard. Spraying of crop with Metasystox 25 ec at the rate of 1.0 litre per hectare in 1,000 litre of water is quite effective in controlling this insect.

Diseases

Diseases of chickpea: Wilt and collar rot could be minimized by seed treatment, deep summer ploughing selection of disease resistant varieties and practicing crop rotation.

Disease of Indian mustard: *Alternaria* blight is common disease. To control this disease spray of Dithane M-45 at the rate of 2 kg in 1,000 litre of water per hectare at 10 days interval as the symptoms start appearing on the plants.

Crop productivity

Crop productivity in terms of chickpea equivalent yield (16%) and

water use efficiency (19%) increased under mixed cropping of chickpea + Indian mustard over sole cropping of chickpea (Table 1).

Economics

Economic analysis revealed that intercropping of chickpea + Indian mustard was beneficial over traditional practice of sole cropping of chickpea in terms of higher net returns and benefit: cost ratio (B:C ratio) over sole cropping of chickpea (Table 2). Mixed cropping recorded net returns of ₹ 98,491 per hectare which is 20% higher than sole chickpea cropping, indicating its superiority over traditional practice of sole cropping of chickpea. The benefit cost ratio increased from 3.44:1 to 4.29:1 under mixed cropping of chickpea + Indian mustard over sole cropping of chickpea.

Intercropping of chickpea + Indian mustard conserved higher soil moisture, because of efficient soil moisture utilization it registered higher water use efficiency, recorded higher net profit in comparison to sole cropping of chickpea thus indicated its effectiveness for the region.

SUMMARY

The chickpea is usually grown in pure stand (farmer's practice) in winter season under rainfed condition in Bundelkhand region in Central India and many times it fails because of infestation of wilt and attack of pod borer. Present study concluded on intercropping of chickpea + Indian mustard (8:1) revealed that productivity, net profit and water-use-efficiency were recorded higher over sole cropping of chickpea. Under rainfed/limited irrigation conditions, chickpea + Indian mustard intercropping system could be successfully adopted for conservation of soil moisture, efficient soil moisture utilization and obtaining assured production over sole cropping of chickpea in Bundelkhand region and Madhya Pradesh.

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Table 2. Economics of chickpea + Indian mustard intercropping*

Treatment	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	B:C ratio
Sole chickpea	23,775	105,670	81,895	3.44:1
Chickpea + Indian mustard (8:1)	22,959	121,450	98,491	4.29:1

*For computation of economics, Nov. 2016 rates were considered