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## Growth and biomass productivity of sesame, greengram, urdbean and mustard as influenced by moisture conservation practices under mustard based cropping system

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#### Abstract

A field experiment was carried out during 2016-17 and 2017-18 at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.) to evaluate the effect of moisture conservation practices on growth and biomass productivity of sesame, greengram, urdbean and mustard under rainfed condition. Result revealed that the tallest plant of sesame (94.0 cm), greengram (37.8 cm) and urdbean (33.7 cm) was recorded under lifesaving irrigation but dry matter accumulation/plant of sesame (6.8 g), greengram (3.9 g) and urdbean (3.5 g) were significantly maximum in straw mulch 4 t/ha followed by lifesaving irrigation. In mustard the tallest plant of 195 cm was recorded under lifesaving irrigation but number of branches (6.82) and dry weight/plant (39.8 cm) were significantly superior in straw mulch treatment. The maximum biomass productivity of sesame (3070 kg/ha), greengram (3633 kg/ha), urdbean (3270 kg/ha) was recorded in straw mulch 4 t/ha however, biomass productivity of mustard (7751 kg/ha) was found significantly superior in straw mulch 4 t/ha.

**Keywords:** Life-saving irrigation, straw mulch, kaolin, sesame, greengram, urdbean, mustard, growth, biomass productivity

#### Introduction

India is one of the major oilseed producing country in the world. In Kymore Plateau, region of Madhya Pradesh, mustard based cropping system are widely popular under rainfed condition. The productivity of sesame/greengram /blackgram-mustard system is found low due to moisture stress faced by maturity stage of kharif and succeeding mustard crops. Among oilseed crops, rape seed –mustard is most important *rabi* season crop comprising seven different species *viz.* Indian mustard, toria, yellow sarson, brown sarson, gobhi sarson, karan rai and tara mira. In India the estimated area, production and average yield of mustard is 36.68 million hectares, 72.42 million tonnes and average yield 1974 kg/ha respectively, (Anonymous, 2020 -21) [4].

Sesame (*Sesamum indicum* L.) The ancient oil seed crop in India. It is successfully grown during rainy season but its productivity is low because it is grown in marginal lands with least external nutrients supply and limited irrigation. This crop is dominantly due to water stress and weed infestation which can cause a yield falling of up to 86.3% in sesame (Amare *et al.*, 2009) [1].

Greengram [*Vigna radiate* (L) Wilczek] and blackgram (*Vigna mungo*) is an important pulse crop grown during rainy season in almost all the region. In Madhya Pradesh these crops are grown in Nimar, Malwa, Satpura, Tawa and Chambal valley during *kharif* season. The average productivity of these crops is low and the production is not sufficient to meet out the per capita requirement.

Urdbean produces about 24.5 lakh tones 4.6 million hectare of area, with a water stress to maximize the food production with minimum environment degradation. The risk factor can be minimized through *in-situ* moisture conservation, selection of suitable crops and their varieties (Kumar *et al.*, 2008 Rathore *et al.*, 2010) [5]. Raes *et al.* (2009) [6] reported that soil evaporation reduction by 50% was modeled with 100% cover of the soil by organic mulch. Different types of organic mulches have been used to obtain good crop growth and yield in sesame (Ajibola *et al.*, 2014) [3]. Keeping in the above view and part, the present study was under taken to find out the appropriate soil moisture conservation practices on productivity of mustard based cropping system.

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## Materials and Methods

The present field experiment was conducted during *rabi* season of 2016-17 and 2017-18 at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.). The soil of experimental plot was sandy loam in texture having soil pH 7.6, organic carbon 0.51%, available nitrogen 168 kg/ha, available phosphorous 17.8 kg/ha and available potassium 350 kg/ha. Treatment consisted three cropping system *viz* sesame –mustard, greengram-mustard and urdbean- mustard and four moisture conservation practices *viz*. No irrigation, lifesaving irrigation, no irrigation + straw mulch of paddy @ 4t /ha, no irrigation + kaolin 5% spray at 35 DAS stage. Thus four treatments were tried in three replicated randomized block design. The sesame crop (Cv. RT- 351), Greengram (Cv. PDM -139) and urdbean (Cv.Azad-1) were sown on 15<sup>th</sup> July 2016, 17<sup>th</sup> July 2017 and mustard crop (Cv. Pusa mahak) was sown on 02 November, 2016 and 03<sup>rd</sup> November, 2017. Plant spacing was maintained through manual thinning operation at 15 DAS. After 30 DAS greengram and urdbean crop was given fertilized 20 kg N + 40 kg P<sub>2</sub>O<sub>5</sub> + 20 kg K<sub>2</sub>O/ha and sesame crop was fertilizer @ 30 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> + 30 kg K<sub>2</sub>O/ha through urea, DAP and muriate of potash, respectively. Mustard crop was fertilized 120 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> + 30 kg K<sub>2</sub>O/ha through urea, DAP and muriate of potash, respectively. However, half quantity of N + full quantity P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was basally applied at sowing and remaining half N by top dressing In treatment T<sub>1</sub>, irrigation was not given, in T<sub>2</sub> one irrigation was given at 35 DAS, T<sub>3</sub> straw mulch of paddy @ 4 t/ha was spread at 30 DAS of crop in plot and T<sub>4</sub> Kaolin 5% spray at 35 DAS. Remaining all the package and practices was adopted as per recommendation of crop.

## Results and Discussion

### Growth parameters of Sesame, Greengram, Blackgram and Mustard

Plant height and dry weight per plant were significantly improved with moisture conservation practices. Lifesaving irrigation treatment produced significantly tallest plant height of sesame (94.0 cm), greengram (37.8 cm) and urdbean (33.7 cm) than no irrigation, straw mulch and kaolin 5% spray.

While, dry matter accumulation/plant of sesame (6.8 g), greengram (3.9 g) and urdbean (3.5 g) were significantly maximum in straw mulch treatment. The increase in life saving irrigation was due beneficial effect of irrigation on growth parameters of crop. However, straw mulch checks evaporation loss of water from soil and reduced weed density and maintains soil temperature while, kaolin 5% spray reduced transpiration of water from leaf. Plant height, number of branches and dry weight per plant of mustard were recorded significantly higher under lifesaving irrigation than no irrigation, straw mulch and kaolin 5% spray. The formation of branches /plant and dry weight /plant were significantly maximum under straw mulch treatment (6.82 branches/ plant and 39.8 g dry weight/ plant) than no irrigation and at par to remaining treatments. Lifesaving irrigation, straw mulch and kaolin 5% spray improve dry weight / plant by 1.5 g, 4.9 g and 0.8 g /plant over control, respectively. The incensement in life saving irrigation was due to beneficial effect of irrigation on growth of crop, straw mulch due to restrict evaporation from soil and suppress weed density and maintains soil temperature while, kaolin 5% spray reduced transpiration of water from leaf. Awasthi *et al.* (2007)<sup>[2]</sup> and Singh *et al.* (2002) reported similar findings. This could be ascribed due to greater value of growth characters and yield attributes of conserving crops under straw mulch and lifesaving irrigation.

### Effect of Biomass Productivity of Sesame, Greengram, Blackgram and Mustard

The biomass productivity in term of biological yield of sesame, greengram, urdbean was obtained significantly higher under straw mulch treatment 3070 kg/ha, 3633 kg/ha, 3270 kg/ha followed by lifesaving irrigation. Mustard crop was obtained significantly higher under straw mulch 7751 kg/ha followed by lifesaving irrigation. The superior biological yield could be ascribed due to higher growth parameters *viz*. dry weight per plant, and number of branches of per plant. The highest biomass production which was statistically superior over no irrigation, lifesaving irrigation and kaolin 5% spray. This might be due to higher seed and straw yield of mustard under straw mulch treatment.

**Table 1:** Effect of moisture conservation practices on growth and biological yield of sesame (pooled for two years)

Moisture conservation practices	Plant height		Dry weight (g) at 50 DAS	Biological yield (kg/ha)
	At 50 DAS	At harvest		
No irrigation	89.1	86.4	6.6	2695
Lifesaving irrigation	96.9	94.0	6.9	2808
Straw mulch	93.3	90.5	7.6	3070
Kaolin 5% spray	94.0	91.2	6.8	2752
S.Em. ±	0.37	0.36	0.09	27.52
CD (P=0.05)	1.11	1.08	0.26	11.5

**Table 2:** Effect of moisture conservation practices on growth and biological yield of greengram (pooled for two years)

Moisture conservation practices	Plant height (cm) at 50 DAS	Dry weight (g) at 50 DAS	Number of Nodules /plant	Biological yield (kg/ha)
No irrigation	33.2	3.4	22.5	3190
Lifesaving irrigation	34.6	3.6	23.4	3323
Straw mulch	37.5	3.9	25.6	3633
Kaolin 5% spray	33.9	3.5	22.9	3256
S.Em ±	0.38	0.04	0.27	35.4
CD (P=0.05)	1.13	0.13	0.82	30.8

**Table 3:** Effect of moisture conservation practices on growth and biological yield of urdbean (pooled for two years)

Moisture conservation practices	Plant height (cm) at 50 DAS	Dry weight (g) at 50 DAS	Number of Nodules /plant	Biological yield (kg/ha)
No irrigation	31.8	3.1	20.0	2871
Lifesaving irrigation	33.2	3.2	21.1	2990
Straw mulch	35.9	3.5	23.0	3270
Kaolin 5% spray	32.5	3.1	20.6	2931
S.Em ±	0.36	0.04	0.25	305.4
CD (P=0.05)	1.08	0.11	0.74	29.2

**Table 4:** Effect of moisture conservation practices on growth and biological yield of mustard (pooled for two years)

Moisture Conservation Practices	Plant height (cm)	Number of branches / plant	Dry weight (g) at 50 DAS	Biological yield (kg/ha)
No Irrigation	179.9	5.99	34.9	6806
Life Saving Irrigation	195.6	6.24	36.4	7090
No Irrigation + Straw mulch	188.5	6.82	39.8	7751
No Irrigation + kaolin 5% spray	189.9	6.12	35.7	6948
S.Em ±	0.96	0.09	0.55	751
CD (P = 0.05)	2.82	0.28	1.62	18.9

### Conclusion

Thus, it can be concluded that application of straw mulch was found best treatment for higher growth and biological yield of sesame, greengram, blackgram and mustard under mustard based cropping system.

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