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Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on yield attributes and yield of summer sesame on Alfisols

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Abstract
A field experiment was conducted during Summer-2022 at Regional Agricultural Research Station, Warangal, Professor Jayashankar Telangana State Agricultural University, Telangana to study the "Effect of application of 100% and 150% RDF of HDPS cotton and varied RDF of sesame on growth, yield attributes and yield of summer sesame on Alfisols. The number of capsules plant^{-1}, seed and stalk yield of sesame was recorded higher (64, 783 and 1941 kg ha^{-1}, respectively) in residual soil fertility of 150% RDF of HDPS cotton and lower (62, 739 and 1832 kg ha^{-1}, respectively) was found in 100% RDF of HDPS cotton. Among varied RDF of sesame, the number of capsules plant^{-1}, seed and stalk yield (72.07, 853 kg ha^{-1} and 2106 kg ha^{-1}, respectively) was found significantly higher with application of 125% RDF (100-25-25) of sesame (T_5) over control (T_1) and 50% RDF of sesame (40-10-10) (T_2) but at par with 75% RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Keywords: RDF, HDPS cotton, yield attributes, yield, summer sesame

Introduction
The demand for vegetable oil in India is increasing steeply owing to increase in population, improvement in standard of living, increasing industrial requirement besides the current global pressure on bio-fuels. Sesame (*Sesamum indicum* L.) is one of the important oilseed crops in Indian agriculture, and it is called "Queen of oilseeds", because of its quality. (Malik *et al*., 2003) [2]. India ranks first in area (45%), production (36%) and export (45%) of sesame in the world. In India, sesame is cultivated in 16.22 lakh hectares of area with production 6.57 lakh tonnes and productivity 405 kg ha^{-1} during 2019-2020 (www. Indiastat.com). Sesamum is a short duration crop and is suitable for cultivation in *kharif*, late *kharif* and summer. Sesamum can be taken as summer crop (with sowings in January-February) after crops like cotton, turmeric, rice, maize, redgram, groundnut etc. Summer crop generally gives better grain quality and higher yields than *kharif* due to lower incidence of pests and diseases. The *kharif* sesame is often caught in rains at maturity resulting in discoloured grains due to mould incidence and fails to attract export market. On the other hand, summer produce is disease free with good quality seeds of attractive colour and less incidence of pests and diseases. (Kumara *et al*., 2014) [1].

In Telangana state, cotton growing under high density planting system is popularized, as the majority of the soils are having low to medium fertility. Irrespective of the type of soils, under HDPS cotton farmers are applying higher dose of fertilizers to supply nutrients sufficient to increased population to give higher yields. Keeping in view utilizing the residual effect of fertilizers applied in HDPS cotton with low fertility demand by the sesame, the sesame crop can be grown after cotton in HDPS system.

Materials and Methods
The present investigation was carried out at Regional Agricultural Research Station, Warangal. The geographical grid of the experimental site is 18^0 05' N Latitude, 79^{0}35' E Longitude with an altitude of 240 m above mean sea level. Agro-climatologically the area is classified as Central Telangana Zone of Telangana state.

The cotton is grown under high density planting system in *Kharif* season with two different fertilizer doses *viz.*, 100% RDF of HDPS cotton (120:60:60 kg N, P_2O_5 and K_2O ha^{-1}) and 150% RDF of HDPS cotton (180:90:90 kg N, P_2O_5 and K_2O ha^{-1}) as two main plots and the summer sesame is grown in residual soil fertility after HDPS cotton as five sub-plots with

varied RDF of sesame of 50%, 75%, 100% (80:20:20) and 125% RDF of sesame along with absolute control in a split plot design replicated thrice.

Growth parameters recorded on summer sesame were plant height at 30DAS, harvest and dry matter production at 30 DAS; number of capsules plant^{-1}, seed yield and stalk yield were recorded at harvest. The plant height was measured from the base of the plant *i.e.*, ground level to the tip of the main shoot from the five randomly selected plants in each net plot at 30 DAS and at harvest. An average plant height was recorded and reported in centimetres.

Shoot dry matter production was recorded at 30 DAS from five plants. Five plants from each plot were cut to the base at each stage. The aerial portion of the plant was kept in brown paper bags and was air dried for 48 hours and then placed into hot air oven at regulated temperature of 60 ± 2 °C. The weight of the oven dried plant samples were recorded using electrical balance and the mean value was recorded as the dry matter accumulation and expressed in kg ha^{-1}. The green capsules from randomly selected five plants from net plot were picked and total numbers of green capsules were counted. Then average number of green capsules per plant was estimated.

The seed and stalk yield obtained per net plot area was used for computation of seed and stalk yield expressed in kg ha^{-1}.

The statistical analysis of data recorded for different characters during the course of investigation was carried out through the procedure appropriate to the design of the experiment as described by Panse and Sukhatme (1985) [12]. The significance of difference was tested by 'F' test. Five percent level of significance was used to test the significance of results. The critical differences were calculated when the differences among treatments were found significant in 'F' test.

Results and Discussion

Plant height at 30 DAS

The plant height of sesame at 30DAS recorded significantly higher (66.33 cm) by the residual soil fertility of 150% RDF of HDPS cotton (180-90-90) over (60.82) residual soil fertility of 100% RDF of HDPS cotton (120-60-60). Among varied RDF of sesame, the plant height at 30 DAS was found higher (69.56 cm) with 125% RDF of sesame (100-25-25) (T_5) and lower were recorded in control (56.79cm) (Table-1).

Table 1: Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on plant height of sesame at 30 DAS (flowering stage)

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	55.51	57.80	61.12	62.86	66.80	60.82
150% RDF of HDPS cotton	58.06	64.19	66.86	70.22	72.33	66.33
Mean	56.79	60.99	63.99	66.54	69.56	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	5.44		0.83			
RDF of sesame	NS		3.42			
RDF of sesame at same level of RDF of HDPS cotton	NS		1.86			
RDF of HDPS cotton at same level RDF of sesame	NS		4.41			

Plant height at harvest

The plant height of sesame at harvest recorded significantly higher (85.69 cm) by the residual soil fertility of 150% RDF of HDPS cotton (180-90-90) over (82.38 cm) residual soil fertility of 100% RDF of HDPS cotton (120-60-60) (Table-2). The plant height among varied RDF of sesame at harvest were found significantly higher (92.33 cm) with application of 125% RDF of sesame (100-25-25) (T_5) over control (T_1) and 50% RDF of sesame (40-10-10) (T_2) but on par with 75% RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Increase in plant height might be due to higher levels of nitrogen coupled with proportionate enhancement in the supply of phosphorus and potassium which might be involved in increasing number and size of cell, which ultimately increased plant height of summer sesame. Linear increase in plant height with increased level of fertilizer as evident in this investigation was found to be similar with the findings of Thorve *et al*. (2010) [6], Thentu *et al*. (2014) [5] and Muneshwar *et al*. (2019) [10].

Table 2: Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on plant height at harvest

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	73.60	80.73	83.12	85.47	89.00	82.38
150% RDF of HDPS cotton	76.00	82.00	85.26	89.54	95.67	85.69
Mean	74.80	81.37	84.19	87.51	92.34	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	NS		1.89			
RDF of sesame	10.39		3.43			
RDF of sesame at same level of RDF of HDPS cotton	NS		4.22			
RDF of HDPS cotton at same level RDF of sesame	NS		4.74			

Dry matter accumulation

The higher dry matter production of sesame at 30 DAS (560 kg ha^{-1}) was recorded in residual soil fertility of 150% RDF of HDPS cotton and lower (511 kg ha^{-1}) was found in residual soil fertility of 100% RDF of HDPS cotton (Table-3). The dry matter production among varied RDF of sesame found significantly higher (610 kg ha^{-1}) with application of 125% RDF of sesame (100-25-25) (T_5) over control (T_1), 50% RDF of sesame (40-10-10) (T_2) but at par with 75%RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Dry matter accumulation is the pre-requisite for higher yields in summer sesame and this might be attributed to the reason

that increased levels of fertilizer might have increased assimilatory surface area per plant which have led to higher photosynthesis rate and ultimately lead to the accumulation of a large quantity of photo assimilates consequently resulted in higher dry matter accumulation. Similar results were reported by Jadhav *et al*. (2015) [3], Thorve *et al*. (2010) [6] and Thentu *et al*. (2014) [5].

Table 3: Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on dry matter production (kg ha^{-1}) at flowering

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	396	462	535	571	590	511
150% RDF of HDPS cotton	461	521	586	603	629	560
Mean	429	492	561	587	610	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	NS		14.71			
RDF of sesame	61.07		20.19			
RDF of sesame at same level of RDF of HDPS cotton	NS		32.90			
RDF of HDPS cotton at same level RDF of sesame	NS		29.48			

Number of capsules plant^{-1}

Higher number of capsules plant^{-1} (64) of sesame was recorded in residual soil fertility of 150% RDF of HDPS cotton and lower (61.64) was found in 100% RDF of HDPS cotton (Table-4). Among varied RDF of sesame, the number of capsules plant^{-1} of sesame was found significantly higher (72.07) with application of 125% RDF (100-25-25) of sesame (T_5) over control (T_1), 50%RDF of sesame (40-10-10) (T_2) and at par with 75% RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Application of higher levels of fertilizers resulted in a greater number of capsules plant^{-1} presumably due to improvement of various growth parameters like dry matter accumulation. Similar trend was supported by Patra (2001) [11] and Vaghani *et al*. (2010) [7]

Table 4: Effect of residual soil fertility with100 and 150% RDF of HDPS cotton and varying RDF of sesame on number of capsules plant^{-1}

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	54.40	56.40	60.76	65.90	70.73	61.64
150% RDF of HDPS cotton	56.70	59.40	64.83	70.46	73.40	64.96
Mean	55.55	57.90	62.80	68.18	72.07	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	NS		0.68			
RDF of sesame	11.42		3.77			
RDF of sesame at same level of RDF of HDPS cotton	NS		1.52			
RDF of HDPS cotton at same level RDF of sesame	NS		4.82			

Seed yield

The seed yield of sesame was recorded higher (783 kg ha^{-1}) in residual soil fertility of 150% RDF of HDPS cotton and lower (739 kg ha^{-1}) was found in 100% RDF of HDPS cotton (Table-5). The seed yield among varied RDF of sesame was found significantly higher (853 kg ha^{-1}) with application of 125% RDF of sesame (100:25:25) (T_5) over control (T_1) and 50% RDF of sesame (40-10-10) (T_2) but at par with 75% RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Higher seed yield with increase in fertilizer levels might be due to enhanced biomass accumulation and its efficient translocation from source to sink which resulted in elevated growth parameters and yield contributing characters which ultimately contributed to in increase in seed yield. The linear increase in seed yield with increased application of fertilizer levels to soil was reported by several workers *viz.*, Katwate *et al.* (2011) [9] and Verma *et al.* (2013) [8].

Table 5: Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on seed yield (kg ha^{-1}).

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	645	682	735	794	841	739
150% RDF of HDPS cotton	716	727	753	856	865	783
Mean	681	705	744	825	853	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	NS		10.46			
RDF of sesame	120.78		39.94			
RDF of sesame at same level of RDF of HDPS cotton	NS		23.39			
RDF of HDPS cotton at same level RDF of sesame	NS		51.59			

Stalk yield

The stalk yield of sesame was recorded higher (1941 kg ha^{-1}) in residual soil fertility of 150% RDF of HDPS cotton and lower (1832 kg ha^{-1}) was found in 100% RDF of HDPS cotton (Table-6). The stalk yield of sesame among varied RDF of sesame was found significantly higher (2106 kg ha^{-1}) with application of 125% RDF of sesame (100:25:25) (T_5) over control (T_1) and 50% RDF of sesame (40-10-10) (T_2) but at par with 75% RDF (60-15-15) (T_3) and 100% RDF of sesame (80-20-20) (T_4).

Table 6: Effect of application of 100 and 150% RDF of HDPS cotton and varied RDF of sesame on stalk yield (kg ha^{-1}).

RDF of HDPS cotton	RDF of sesame					Mean
	Control	50%	75%	100%	125%	
100% RDF of HDPS cotton	1,581	1,739	1,838	1,918	2,086	1,832
150% RDF of HDPS cotton	1,650	1,911	1,991	2,024	2,127	1,941
Mean	1,616	1,825	1,915	1,971	2,107	
Factors	CD (P=0.05)		SEm ±			
RDF of HDPS cotton	NS		44.46			
RDF of sesame	208.35		68.90			
RDF of sesame at same level of RDF of HDPS cotton	NS		99.42			
RDF of HDPS cotton at same level RDF of sesame	NS		97.84			

Higher levels of fertilizers applied to soil resulted in enhanced vegetative growth with taller plants, higher dry matter accumulation which in turn fetched higher stalk yield. The increased stalk yield with increase in level of fertilizer as resulted from the present investigation corroborates with the findings of Jadhav *et al.* (2015) [3] and Shinde *et al.* (2014) [4].

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