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Residual effect of organic nutrient management practices on growth and yield of sesame (*Sesamum indicum* L.)

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Abstract
A field experiment was carried out to study the residual effect of nutrient management practices on growth, yield attributes and yield of sesame at Agricultural Research Sub Station, Sumerpur, Rajasthan during kharif, 2014. The experiment was laid out in randomized complete block design with 7 treatments replicated thrice. The results of experiment revealed that the residual effect of different nutrient sources applied to wheat significantly influenced the growth attributes (plant height), yield attributes (number of branches plant^{-1}, number of capsules plant^{-1}, number of seeds capsule^{-1}), test weight and seed yield of sesame. The maximum growth attributes and seed yield of sesame (334 kg/ha) was recorded by residual effect of FYM @ 10t/ha + neem leaves @ 2t/ha which was statistically at par with residual effect of FYM @ 15t/ha and FYM @ 5t/ha + neem leaves @ 2t/ha + vermicompost @ 1.25t/ha.

Keywords: Nutrient management, residual effect, growth, yield, sesame.

1. Introduction
The rainfed agro-ecosystem in India covers arid, semi-arid and sub humid zones which represents more than 70% of the geographical area. Most of the soils of arid region possess less than 0.5% organic matter (OM) which is below the optimum level. This low level of OM affects the physical, chemical and biological conditions of the soil. Many researchers reported that indiscriminate use of inorganic fertilizers deteriorates the chemical, physical, and biological properties of the soil. The negative effects of chemical fertilizers and escalating prices, have led to growing interests for use of organic manures in agriculture as a source of nutrients [16]. The application of organic fertilizers is a major component of organic farming practices [5]. Organic manures can provide the essential plant nutrients and enhance crop productivity, but also leave a beneficial residual effect on succeeding crops [9]. Incorporating organic materials into soil results in improved soil physical attributes viz., soil structure, soil aggregate stability, water holding capacity, soil drainage, soil aeration and root penetration, soil chemical attributes viz., soil macro and micro nutrient content, soil pH [6, 13]. Application of organic manures on sesame in form of crop residues and animal manure would most likely improve its yields and seed quality [3, 4, 12].

Sesame (*Sesamum indicum*) belongs to the family Pedaliaceae and an important oilseed crops in Indian agriculture. It is also grown in many parts of the world for its insecticidal and medicinal properties as well as for its cosmetic and ornamental values. It's oil has excellent nutritional, medicinal, cosmetic, cooking qualities and its cake is a rich source of protein, carbohydrates and minerals, such as calcium and phosphorus for which it is known as 'the queen of oils'. It is cultivated on a large scale in the states of Maharashtra, Uttar Pradesh, Rajasthan, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, West Bengal, Gujarat, Karnataka, Kerala, Bihar, Assam and Punjab and to a limited extent, in Tripura and Himachal Pradesh [10]. It ranks third and fourth in terms of total oilseed area and production in the country, respectively.

The crop is now grown in a wide range of environments, extending from semi-arid tropics and subtropics to temperate regions. This probably indicates a great opportunity for a prolonged and higher increase in productivity of sesame. But the productivity of sesame in country is much lower (274 kg ha^{-1}) than its potential yield [2]. Lower productivity is due to use of sub-optimal rate of fertilizer, poor management and cultivation of sesame in marginal and

sub-marginal lands where deficiency of macronutrients such as nitrogen, phosphorus, potassium and micronutrient is predominant [14]. Supply of nutrients through organic source of nutrients (farmyard manure, vermicompost) to the first crop in a cropping system and raising second crop on the residual fertility of those organic manures along with the application of neem leave can help to maintain the soil nutrient reserves for attaining higher crop yields in sequence cropping system. With this background, the present investigation was carried out to study the effect of nutrient management practices in organic sesame-wheat cropping system under hot arid condition and their residual effect on succeeding sesame.

Material and Methods

A field experiment was conducted during Kharif season of 2014 at Agricultural Research Sub Station, Sumerpur (23°39' N, 87°42' E and 51 m above mean sea level), Pali, Rajasthan. Before conducting the experiment, initial composite soil samples (0-15 cm depth) were collected from the experimental plots and were analyzed. The soil of experimental field having low soil organic carbon (0.32%), low available N (214 kg/ha), medium available P (15.97 kg/ha) and K (257.61 kg/ha) with alkaline pH 8.2. Experiment on wheat was laid out in a randomized black design having three replications with seven treatments viz. T_1: control, T_2: FYM @ 15t/ha, T_3: Neem green leaves @ 6t/ha, T_4: FYM @ 10t/ha + Neem green leaves @ 2t/ha, T_5: FYM @ 10t/ha + Vermicompost @ 1.25t/ha, T_6: Neem green leaves @ 4t/ha + Vermicompost @ 1.25t/ha and T_7: FYM @ 5t/ha + Neem green leaves @ 2t/ha + Vermicompost @ 1.25t/ha. Sesame (var. RT-127) was taken as a test crop to observe residual effect of these treatments. Sesame was sown in the same plots as a residual crop after harvesting of wheat. All the recommended package of practices were followed during the period of investigation. Growth parameters such as plant height, number of branches/plant, yield attributes such as number of capsules/plant, seeds/capsule, test weight and seed yield of sesame were recorded at harvest stage of crop. Number of capsules per plant and number of seeds per capsule were counted from five randomly selected plants per plot. Plant height is one of the growth parameters that was measured from five plants per plot. To determine the number of seeds per capsule, the seeds of five capsules (lower, medium, and upper most position on the plant) from each of five plants were counted. Test weight was determined by counting 1000 seeds from each plot after threshing. Seed yield of each plot was weighed in grams and converted to area basis to determine the yield kg/ha.

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Residual effect of organic nutrient management practices on plant height

The data pertaining to plant height of sesame revealed that treatments applied to preceding wheat crop had a positive residual effect on growth parameters like plant height of sesame (Table 1). Residual treatment T_4 (FYM @ 10t/ha + Neem green leaves @ 2t/ha) resulted in significantly taller plants (85.20 cm) than all other treatments at harvest stage of crop. The height was found to be lowest (70.0 cm) with control (T_1). The plant height might be due to residual effect of organic manure in combination of neem leaf, because neem leaf reduces the nitrification processes and enhance nutrient use efficiency of fertilizers [17].

Residual effect of organic nutrient management practices on number of branches/plant

During the present investigation, it was observed that different nutrient management practices employed in wheat-sesame cropping system had significant residual impact on number of branches plant^{-1} of succeeding sesame crop. Among nutrient management treatments, residue of FYM @ 10t/ha + Neem green leaves @ 2t/ha recorded the maximum number of capsules/plant (4.7) being at par with residue FYM @ 15t/ha and FYM @ 5t/ha + Neem green leaves @ 2t/ha + Vermicompost @ 1.25t/ha. The addition of organic manures and neem leaves to preceding crop might have a positive impact on all the yield contributing characters of sesame. Vermicompost with neem leaf powder was found suitable for growth and yield of carrot [1].

Residual effect of organic nutrient management practices on number of capsules/plant

The number of capsule plant^{-1} of sesame significantly influenced by the residual effect of nutrient management practices applied to preceding wheat crop (table 1). It is clearly indicated that highest number of capsule per plant was recorded in T_4 (44.0) which were at par with T_2 and T_7 and control (T_1) resulted in lowest number of capsule plant^{-1} (20.33). Number of capsules per plant in sesame increased with application of neem seed cake [8].

Residual effect of organic nutrient management practices on number of seeds/capsule

The data related to number of seed capsule^{-1} is presented in table 1 indicated that different levels of nutrient management treatments on wheat has significant residual impact on the number of seed capsule^{-1} in sesame over control. The number of seeds per capsule was significantly higher with residual effect of FYM @ 10t/ha + Neem green leaves @ 2t/ha (52.3) during the year of investigation which was at par with T_2, T_7 and T_5. The number of seed per capsules increased due to residual effect of FYM @ 10t/ha + Neem green leaves @ 2t/ha over control was 29.44%.

Residual effect of organic nutrient management practices on test weight and seed yield

It is noticed from the data presented in table 1 that the treatments applied to wheat did not able to produce significant effect on test weight of sesame. However, T_4 (FYM @ 10t/ha + Neem green leaves @ 2t/ha) recorded numerically higher test weight than other treatments. Residual effect of 75% RDNF+25% N through neem cake on greemgram did not show significant effect on test weight [7]. Whereas, the various sources of nutrition management practices applied to wheat have significant residual impact on the seed yield of succeeding sesame (table 1). From the data, it could be observed that T_4 (FYM @ 10t/ha + Neem green leaves @ 2t/ha) resulted in significantly higher seed yield 334 kg ha^{-1} which was 67.4% higher than the control (109 kg ha^{-1}). This might be attributed to the residual effect of the organics nutrient added to the wheat as it was reported that organic sources of nutrient applied to the preceding crops benefit the succeeding crops to a great extent [11]. Sorghum yield was increased when compost and neem leaf mulches were combined used [18]. Similarly, combined application of neem

extract and nutrient sources enhances the growth and yield of okra [15].

Conclusion

Nutrient management practices is one of the important issues for sustainable crop production. It can be concluded that application of FYM @ 10t/ha + Neem green leaves @ 2t/ha applied to wheat crop significantly increased growth parameters, yield attributes and seed yields of succeeding sesame crop.

Table 1: Residual effect of nutrient management practices on growth, yield attributes and yield of sesame

Treatment	Plant height (cm)	Number of branches plant^{-1}	Number of capsules plant^{-1}	Number of seeds capsule^{-1}	Test weight (g)	Grain yield (kg/ha)
T_1	70.00	1.7	20.33	36.9	2.53	109
T_2	81.60	4.0	42.83	50.0	2.58	296
T_3	75.00	3.0	33.60	45.2	2.55	218
T_4	85.20	4.7	44.00	52.3	2.91	334
T_5	79.20	3.3	37.60	48.0	2.57	263
T_6	78.47	2.3	28.07	43.5	2.53	202
T_7	80.00	4.0	42.60	49.3	2.59	294
SEm+	1.53	0.39	1.40	1.94	0.13	14.92
CD (p=0.05)	4.63	1.19	4.25	5.87	0.40	45.25

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