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Growth, Yield and Quality of *Rabi* Sunflower as Influenced by Moisture Absorbents, Organic and Inorganic Fertilizers

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Abstract

A field experiment was carried out at Experimental Farm,Oilseeds Research Station, Latur to study the yield attributes ofwinter sunflower as influenced by absorbents, organic and inorganic fertilizers during the year of winter season 2016. The experimental field was uniform and levelled. The soil was black in colour low in available nitrogen (201.20 kg ha^{-1}), low in available phosphorus (15.90 kg ha^{-1}), high in available potash (483.80) and organic carbon (0.55%) withalkaline in reaction.The gross and net plot size were 5.4×4.8 m^2 and 4.2×4.2 m^2 respectively. There were seven treatment viz. RDF (90:45:45) NPK Kg ha^{-1}, RDF+FYM @ 5 t ha^{-1}, RDF+FYM @ 2.5 t ha^{-1}, RDF+Hydrogel @ 2.5 kg ha^{-1}, RDF+Humic acid @ 2.5 kg ha^{-1}), RDF+Vermicompost @ 2.5 t ha^{-1} and RDF+Fly ash @ 2 t ha^{-1} which replicated thrice in Randomised Block Design. Data presented in Table 1 revealed that higher values of growth attributes i.e. plant height (205.37), No of leaves plant^{-1} (26.20), Dry matter plant^{-1} (146.50 g), Stem girth (9.13 cm), leaf area (75.68 dm^2), head diameter (12.93 cm), seed yield (1770 kg ha^{-1}) due to the treatment of RDF+Hydrogel @ 2.5 kg ha^{-1}. The result indicated that, the higher number of filled seeds plant^{-1} (841.67), seed yield plant^{-1} (41.76 g), test weight (54.33 g), harvest index (36.67%), seed yield (1770 kg ha^{-1}), oil content (37.97%), oil yield (672.06 kg ha^{-1}) by the application of RDF along with hydrogel @ 2.5 kg ha^{-1}. The highest stalk yield (4031.54 kg ha^{-1}) was observed with RDF (90:45:45 NPK kg ha^{-1}).

Keywords: Hydrogel, Organic, RDF, Humic acids, fym, vermicompost, NPK

1. Introduction

Sunflower (*Helianthus annuus* L.) holds great promise as an oil seed crop because of its short duration, photo insensitivity and wild adaptability to different agro-climatic regions and soil types. Sunflower can play an important role in meeting out the shortage of edible oil in country. Our country is facing acute shortage of edible oil mainly because of heavy demand due to population pressure, raised standard of living and high demand from oil consuming industries. This demand is partly met by import of edible oils. Under such situation it needs to build up self-sufficiency in oil production and to meet the increasing demand of consumers.

In India, the area under oilseed crop is 285.25 lakh ha with production of 328.77 lakh tonnes and productivity is 1094 kg ha^{-1}. The area under sunflower crop in world is 23.71 mha and production is 32.39 mt with the productivity of 701 kg per ha. Whereas, in India the area under sunflower crop is 6.91 lakh ha and production was, 5.47 lakh tonnes with the productivity of 791 kg ha^{-1}. In Maharashtra, sunflower is cultivated on an area of 61 thousand ha and production is 38 thousand tonnes with the productivity of 623 kg ha^{-1}. In Marathwada region of the state accounts about 50 thousand ha of area, 30 thousand tones of production and 602 kg ha^{-1} productivity compared to state (Anonymous, 2013–14). Sunflower occupies fourth place among oilseed crops in terms of acreage and production. Farmers find sunflower as a highly profitable crop. The important sunflower growing states in the country are Karnatka, Andra Pradesh, Maharashtra and Tamil Nadu. Almost fifty percent of the area accounted by Karnataka follwed by Andra Pradesh, Maharashtra and Tamil Nadu. The major sunflower producing districts in Marathwada are Latur, Parbhani, Nanded, Hingoli, Beed, Aurangabad and Osmanabad where the crop is largely cultivated under rain fed conditions during late *kharif/rabi* season. Due to its short duration, it is ideally grown more between August and October.

Sunflower seed is highly nutritious containing 14–19% protein and 40–45% oil associated with very calorific value and 30–35% carbohydrates. The oil is considered to be a high quality due to its non-cholesterol properties. It contains oleic and linoleic acid, therefore it is recommended for the patients having heart problem. It contains sufficient amount of calcium, iron and vitamins like A, D, E and B complex. Sunflower oil is primarily used for cooking and is a major ingredient in some margarine and shortening products. High linoleic acid sunflower seeds are used for confectionary purposes. Sunflower oil has good keeping quality. The oil cake contains 40–44% high quality protein. It is ideally suited for poultry and livestock ration . It can also be used for manufacturing baby foods. The sunflower kernel can be eaten raw or roasted. The oil is used for culinary purpose, in the manufacture of paints, soaps and cosmetics. The importance of sunflower as an oilseed crop in India is of very recent origin and date backs to three decades. But its contribution towards attaining self-sufficiency in edible oil as well as to " yellow revolution" in the country is note worthy (Mangala Rai, 2002).

Hydrogel are super absorbents that absorb and store water hundreds of times own weight, i.e. 400–1500 g water per dry gram of hydrogel (Johnson, 1984a; Bowman, Evans, 1999). Their performance is determined by the chemical properties of the hydrogel, such as molecular weight, formation conditions of the hydrogel, as well as the chemical composition of the soil solution of irrigation water. Water held in the expanded hydrogel is intended as a soil reservoir for maximizing the efficiency of plant water uptake. Also improving drainage and reduce runoff water losses. Commonly used hydrogels can be generally devided into three classes: natural polymers, semisynthetic and synthetic polymers (Mikkelsen, 1994). Synthetic hydrogels usually consist of polyacrylamides (PAM) and polyvinylalcohols. Fully synthetic polymers are chemically cross-linked to prevent them from dissolving in solution (Mikkelsen, 1994). The non-cross-linked PAM form is effectively used for soil erosion control, sediment reduction in surface waters and earthen canal bed stabilization (Woodhouse, Johnson, 1991).

Humic acids are heterogeneous, which include in the same macromolecule, hydrophilic acidic functional groups and hydrophobic groups. Humic acid hydrophilic groups attract hydration, thus increasing the water retention capacity in soils. Stevenson (1994). Humic acids (HAs) are the main fractions of humic substances (HS) and the most active components of soil and compost organic matter. HAs have been shown to stimulate plant growth and consequently yield by acting on mechanisms involved in: cell respiration, photosynthesis, protein synthesis, water and nutrient uptake, enzyme activities (Vaughan and Malcolm, 1985; Albuzio, 1986; Chen and Aviad, 1990; Concheri, 1994; Nardi, 1996; Chen, 2004).

Vermicomposts are products derived from the accelerated biological degradation of organic wastes by earthworms and microorganisms. Earthworms consume and fragment the organic wastes into finer particles by passing them through a grinding gizzard and derive their nourishment from microorganisms that grow upon them. Vermicomposts are finely divided peat-like materials with high porosity, aeration, drainage, water-holding capacity (Edwards and Burrows, 1988). They have greatly increased surface areas, providing more microsites for microbial decomposing organisms, and strong adsorption and retention of nutrients (Shi-wei and Fu-zhen, 1991).

Fly ash is a resultant waste produced from the combustion of coal in thermal power plants. Several researches have already proposed that low dose of fly ash amendments improves the physicochemical properties of the soil such as pH, texture, water holding capacity, electrical conductivity etc. (Kishore et al. 2010, Sajwan et al., 2003; Siddique, 2004; Lee et al., 2006). Enriching soil with fly ash increased the plants.

2. Materials and Methods

A field experiment was carried out at Experimental Farm, Oilseeds Research Station, Latur to study the Growth, yield and quality of *rabi* sunflower as influenced by absorbents, organic and inorganic fertilizers during the year of winter 2016–17 on sunflower hybrid (LSFH-171). The trial was laid out in a Randomized Block Design (RBD) with seven treatments were replicated thrice. The soil of the experimental plot was black in colour, Topography was uniform and levelled. The crop was sown by dibbling method and used the seed rate of 5 kg ha^{-1}. Sowing of seed was done in November 19. Optimum spacing used for sunflower crop was1800 cm^2The recommended dose of fertilizer (90:60:60 NPK kg ha^{-1}) applied through Urea, Single Super Phosphate and Murat of potash. The seven treatments were T_1-RDF (90:45:45) NPK Kg ha^{-1}, T_2-RDF+FYM @ 5 t ha^{-1} (spreading across field), T_3-RDF+FYM @ 2.5 t ha^{-1} (in seed furrows), T_4-Hydrogel @ 2.5 kg ha^{-1} (in seed furrows), T_5-RDF+Humic acid @ 2.5 kg ha^{-1} (in seed furrows), T_6-RDF+Vermicompost @ 2.5 t ha^{-1} (in seed furrows), T_7- RDF+Fly ash @ 2 t ha^{-1} (in seed furrows). In which hydrogel and humic acid applied with mixing sand uniformly in seed furrows of the plots.

3. Results and Discussion

Data presented in Table 1 revealed that growth attributes of sunflower influenced by the application of RDF+Hydrogel @ 2.5 kg ha^{-1} (T_4) to sunflower crop was recorded significantly higher dry matter $plant^{-1}$ (146.50 g), stem girth (9.13 cm), leaf area (75.68 dm^2) which was at par with the treatment of RDF+Humic acid 2.5 kg ha^{-1} (T_5) and application of RDF+FYM 5 t ha^{-1} (T_2). Mean while the treatment of application of RDF+5 t FYM ha^{-1} showed superior over the rest of treatments. Hydrogel application increases the moisture holding capacity of soil and slowly releasing of moisture. Due to this principal of hydrogel, moisture availability to the soil and crop minimised the moisture stress at various growth stages, leads to heigher growth as well as yield of sunflower crop.

Seed yield of sunflower varied significantly due to different treatments such as application of RDF+Hydrogel 2.5 kg ha^{-1} (T_4) observed significantly higher plant height (205.37 cm) and also highest seed yield (1770 kg ha^{-1}). The treatment RDF+(90:45:45 kg NPK ha^{-1}) and RDF+Fly ash @ 2 t ha^{-1} found lowest over the remaining treatments. Maximum number of leaves (26.20) and head diameter (12.93) were observed significant with application of RDF+Hydrogel @ 2.5 kg ha^{-1}. The

Table 1: Growth attributes of sunflower as influenced by different treatments

Treatments	Plant height (cm)	No. of leaves plant^{-1}	Dry matter plant^{-1} (g)	Stem girth (cm)	Leaf area (dm^2)	Head diameter (cm)	Soil moisture (%)	Seed yield (kg ha^{-1})
T_1: RDF (90:45:45 NPK kg ha^{-1})	184.13	21.77	112.63	7.10	61.00	11.20	25.83	1253
T_2: RDF+5 t FYM ha^{-1}	200.0	24.74	139.43	8.63	74.00	12.67	30.60	1563
T_3: RDF+2.5 t FYM ha^{-1}	193.37	22.80	122.73	7.30	65.04	11.70	26.37	1312
T_4: RDF+Hydrogel @ 2.5 kg ha^{-1}	205.37	26.20	146.50	9.13	75.68	12.93	33.63	1770
T_5: RDF+Humic acid @ 2.5 kg ha^{-1}	202.13	25.13	146	8.99	74.78	12.75	31.92	1567
T_6: RDF+Vermicompost @ 2.5 t ha^{-1}	189.50	24.53	131.61	7.94	71.19	12.07	28.83	1397
T_7: RDF+Fly ash @ 2 t ha^{-1}	188.40	24.27	124.83	7.50	69.50	11.93	27.39	1361
SEm±	4.55	1.276	5.17	0.429	3.017	0.686	-	79
CD (p=0.05)	14.03	NS	15.95	1.321	9.29	NS	-	243

number of leaves per plant and head diameter did not found significantly superior to rest of treatments. Similar results were also reported by Nazarli, H., Zardashti, M.R. (2010).

The yield attributing characters of sunflower *viz.,*no of filled seed, seed yield per plant, test weight, seed yield (kg ha^{-1}), stalk yield (kg ha^{-1}), oil content (%), oil yield (kg ha^{-1}) harvest index (HI) were influenced significantly due to different treatments though highest value of these characters were observed when RDF+hydrogel @ 2.5 kg ha^{-1} (T_4) was applied which was followed by Humic acid @ 2.5 kg ha^{-1} (T_5) and RDF+5 t FYM ha^{-1} (T_2). It might be due to overall improvement in crop growth with the efficient utilization of available moisture and nutrient which empowered the plant to manufacture more quantity of photosynthate accumulating them in sink. Similar trend was also observed by Harphool singh (2012) and khokani et al. (1992).

Data presented in Table 2 revealed that,the yield parameter of sunflower crop was influenced by different treatments. The higher number of filled seed plant^{-1} (841.67), test weight (54.33 g), and oil content (37.97%) with the application of RDF+Hydrogel @ 2.5 kg ha^{-1} (T_4) which was significantly superior to rest of treatments and at par with RDF+Humic acid @ 2.5 kg ha^{-1} (T_5) (Table 1). The seed yield plant^{-1} (41.76 g) was obtained maximum with RDF+Hydrogel @ 2.5 kg ha^{-1} except the treatment RDF (90:45:45 NPK kg ha^{-1}). The greater seed yield (1770 kg ha^{-1}) was recorded at RDF+hydrogel @2.5 kg ha^{1} than all treatments and which is at par with application of RDF+Humic acid @ 2.5 kg ha^{-1} and RDF+5 t FYM ha^{1}. The higher oil yield (672.06 kg ha^{-1}) was obtained significantly superior than remained treatments except the treatments RDF+Humic acid @ 2.5 kg ha^{-1}. The highest value of harvest index was observed by the application of RDF+hydrogel @ 2.5 kg ha^{-1}. Maximum stalk yield was found with application of RDF+(90:45:45 NPK kg ha^{-1}) over remaining treatments and at par with RDF+2.5 t FYM ha^{-1}. The result was found superior due to application of hydrogel. Hydrogel havinghighermoisture holding capacity which leads to higher growth and yield of sunflower crop. Similar results also reported by Chandrashekaran, S. (1989).

Table 2: Seed yield and yield attributes of sunflower as influenced by different treatments

Treatments	No. filled seed plant^{-1}	Seed yield plant^{-1}	Test weight (g)	Stalk yield (kg ha^{-1})	Harvest index (%)	Seed yield (kg ha^{-1})	Oil content (%)	Oil yield (kg ha^{-1})
T_1: RDF (90:45:45 NPK kg ha^{-1})	716.67	32.40	47.07	4031.54	23.71	1253	35.07	439.55
T_2: RDF+5 t FYM ha^{-1}	811.67	40.57	53.13	3315.66	32.04	1563	36.83	575.65
T_3: RDF+2.5 t FYM ha^{-1}	721.00	36.08	48.20	3848.06	25.42	1312	35.63	467.46
T_4: RDF+Hydrogel @ 2.5 kg ha^{-1}	841.67	41.76	54.33	3055.94	36.67	1770	37.97	672.06
T_5: RDF+Humic acid @ 2.5 kg ha^{-1}	823.33	40.85	53.47	3223.62	32.76	1567	37.58	588.87
T_6: RDF+Vermicompost @ 2.5 t ha^{-1}	767.33	38.65	50.27	3324.41	29.5	1397	36.17	507.29
T_7: RDF+Fly ash @ 2 t ha^{-1}	729.67	36.72	49.27	3333.32	28.99	1361	35.80	487.29
SEm±	27.946	1.86	1.451	203.19	-	79	0.57	28.413
CD (p=0.05)	86.105	5.76	4.471	626.06	-	243	1.77	87.245

4. Conclusion

Application of RDF with Hydrogel (2.5 kg ha^{-1}) to winter sunflower was found beneficial to improve the seed yield (1770) and yield attributes such as filled seed plant^{-1} (841.67), test weight (54.33 g), and oil content (37.97%). It was found comparable with application of RDF+Humic acid @ 2.5 kg ha^{-1} and RDF+FYM @ 5 t ha^{-1}.

5. References

Akthar, M., Nadeem, M.A., Amhad, S., Tanveer, A., 1992. Effect of nitrogen on seed yield and quality of sunflower (*Helianthus annuus* L.). Journal of Agricultural Research 30, 479–484.

Aruna and narsareddy, S., 1999. Response of soybean (*glycine max*) conjunctive use of organic and inorganic source of nitrogen. Indian Journal of Agricultural Science 69(5), 382–383.

Buriro, M., Rais Mehar ur, N., Solangi Abdul, W., Soomaro, A., Gandahi Allah, W., Kashani, S., 2015. Impact of organic and inorganic manures on sunflower yield and components. Science International (Lahore) 27(4), 3267–3270.

Byrareddy, K., Uppar, D.S., Vyakaranahal, B.S., Hiremath, S.M., Ravihunje and Nadaf, H.L., 2007. Effect of integrated nutrient managent on sunflower hybrid (KBSH-1) seed production. Karnataka Journal of Agricultural Sciences 21(2), (171–175), 2008.

Barik, A.K., Fulmali, J., 2011. Effect of integrated plant nutrient supply through organic and mineral sources on productivity of summer sesame. Journal of Oilseeds Research 28(2), 120–122.

Bhal, G.S., Parrich, N.S., Ahuja, K.L., 1997. Effect of fertilizer nitrogen and phosphorus on sunflower (*Helianthus annuus* L.) seed yield.Journal of Indian Society of Soil Science 145, 292–296.

Chitale, S., Upadhyay, S.K., Bajpai, R.K., Joshi, B.S., 2004. Effect of higher fertility levels combined with farm yard manure and row spacing on seed yield, oil yield and economics of sunflower (*Helianthus annuus* L.). Journal of Oilseeds Research 21(1), 189–191.

Deshmukh, M.R., Jain, H.C., Duhoon, S.S., Goswami, U., 2002. Integrated nutrient management in sesame (*Sesamum indicum* L.) for Kymore plateau zone of Madhya Pradesh. Journal of Oilseeds Research 19(1), 73–75.

Fahramand, M., Moradi, H., Noori, M., Sobhkhizi, A., Adibian, M., Abdollahi and Rigi Khashayar, 2014. Influences of humic acid on increase yield of plants and soil properties. IJFAS 3-3, 339–341.

Konthoujam, D., Singh, N., Basanta, T., Athokpam, Herojit., Singh., Singh, N.B., Diana, S., 2013. Influence of inorganic, biological and organic manures on nodulation and yield of soybean (*Glycine max*) and soil properties. Australian Journal of Crop Science *AJCS* 7(9), 1407–1415.

Norman, Q.A., Edwards, C.A., 2005. Effects ofvermicomposts on plant growth. (ISWVT2005). Los Banos, Philippines, 16–18.

Nanjundappa, G., shivaraj, B., Janarjuna, S., Sridhara, S., 2001. Effect of organic and inorganic sources of nutrients applied alone or in combination on growth and yield of sunflower (*Helianthus annuus* L.) HELIA, 24, Nr. 34, 115–120.

Nazarli H., Zardashti, M.R., 2010. The effect of drought stress and super absorbent polymer (A200) on agronomical traits of sunflower (*Helianthus annuus* L.) under field condition. Cercetari Agronomic in Moldova 3(143).

Pani, N.K., Samal, P., Das, R., Sahoo, S., 2015. Effect of fly ash on growth and yield of Sunflower (*Helianthus annuus* L.). IJAAR, ISSN, 2223-7054, 7(2), 64–74.

Rasool, F.U., Hassan, B., Jahangir, I.A., 2013. Growth and yield of sunflower (*Helianthus annuus* L.) as influenced by nitrogen, sulphur and farm yard manure under temperate conditions. Journal of Agriculture 11(1), 81–89.