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Influence of sustainable source of nutrient on growth and yield of sunflower (*Helianthus annus* L)

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ABSTRACT

Sunflower is a one of the most important oilseed crop. Production of sunflower with the use of sustainable source of nutrient is cheap as compared with the application of synthetic fertilizers and its quality and soil heath improved by the application of organic chemical (OC) source of nutrient while chemical fertilizers are generally dangers for our environment and soil health. The nutrient requirement of sunflower can easily be carried by the self-made OC source of nutrient through this equation FYM + $CaCO_3$ + H_2O + NO_3→ OC (OC source of nutrient) with very low cost, so a farmer can self-made and fulfill nutrient requirement of crop and can obtain higher yield. A field experiment was carried out during 2013 at village Mir Khan Leghari near Agriculture Training Institute Sakrand, district Nawabshah (Sindh). The sunflower variety HO-1 was sown by using randomized complete block design with tree replications. Three levels of self-made OC source of nutrient *viz:* T_1 = 200 kg/ha, T_2 = 300 kg/ha, and T_3 = 500 kg/ha was used. Regarding to the result maximum plant height, stem girth, number of leaves, head diameter, seed yield (140 cm, 7.60 cm, 16/plant, 15.70 cm, 1580.00 kg/ha, respectively) were recorded in T_3 in which high dose (500 kg/ha) of self-made OC source of nutrient were applied. While the minimum plant height 110 cm, stem girth 3.25 cm, leaves per plant 12, head diameter 9.50 cm, seed yield 1300.40 kg/ha were recorded in T_1 plot, where low dose (200 kg/ha) of self-made OC source of nutrient were applied in this plot.

KEY WORDS: *Helianthus annuus* L, organic-chemical, FYM, calcium carbonate, Pakistan

INTRODUCTION

Pakistan being agriculture country unfortunately facing *a* deficit of edible oil, its major reason is small level farming of oilseed crops in the country. This low-level oilseed farming dose does not fulfill the edible oil demand of the country, so it needs are met through foreigner edible oil imports (Nisar *et al*., 2005). The domestic production of oil is very low and slow. In 2008-2009, it was 6.84 million tons, this is about 24% equal to demand, completing the edible oil need about 76% is imported from foreign countries at 80 billion rupees yearly (GOP, 2009). Keeping its important, government agriculture department of Pakistan is continuing struggle to maximize oilseed crop cultivation and preference is being given to the sunflower crops because of among oilseed crops the sunflower is one of the major crop in the country and most liked by the peoples of Pakistan. Ahmad *et al.* (2009) reported that the sunflower crop is widely adoptable at different agroecological zones; it is an extra drought tolerance crop as well-compare to other crops. Sunflowers well utilize water and available nutrients in the root zone due to its growth are vigor's. However, nutrient management is important for all crops and usually it is carried out through fertilizers, but commercial fertilizer prices are day by day increasing, mainly nitrogen fertilizers. Therefore, farmers should be aware how various inputs affect the crop productivity and how technically use different nutrient sources of inputs with combined form. In this way, fertilizer costs can be minimized and can obtain profitable farming (Muzzammil *et al.* 2009). Babhulkar *et al*. (1980) worked on a different source of nutrient for maximum production; they reported that FYM manures are beneficial for growth and yield and of sunflower. Rasool *et al*., (2013) concluded that 10 ton of farmyard manure plus 120 kg nitrogen per hectare increases the seed yield and oil yield of sunflower. Byrareddy *et al*. (2008) investigated that 8 tones of FYM per hector resulted better crop growth and development mainly taller plants height and maximum number of leaves and seed yield were recorded as compare to the plot where no FYM were applied additionally. For vigor growth and maximum, the integrated use of nutrient source including inorganic and organic is the best choice (Sharma *et al*.,

2008). An inorganic material such limestone is useful against acid soils. It reclaims the soil by decreasing soil acids and increases fertilizer efficiency and supplies the essential plant nutrients such as Ca and Mg. limestone also prevents Mn and Al to become toxic for plant growth and development and makes many other nutrients available as well. Calcium carbonate from limestone is used in agriculture all around the world. For that ground, limestone is preferably and commonly being used for agriculture purpose. This is effective on various physiological and biochemical functions in crop plant cell and its tissue (Bush, 1995). Supanjani *et al*. (2005) investigated and reported that $CaCO_3$ at the rate of 2 t/ha level was found suitable for plant growth, and yield increased while excessive application reduced yield. Calcium carbonate is effective for better plant growth and development in a particular situation which mainly involving soil conditions. Similarly, N fertilizers with 8.0 pH are not suitable higher pH soil for the longer health of the soil, but these N fertilizers with high pH becomes best when they are combined with FYM. In this view, the present study was started to evaluate the effect of self-made organic-chemical (OC) source of nutrient on growth and yield of sunflower.

MATERIALS AND METHODS

A field experiment was conducted at Ashfaque laghari agriculture farm in village Mir Khan Leghari, town Sakrand, district Shaheed Benazirabad (Sindh) Pakistan. The layout of the experiment was randomized complete block design with three replications. The sunflower variety HO-1 was sown with bed furrow, plant to plant spacing 20 cm. Sowing time was August 6, 2013, and seed rate was 12 kg/ha. The soil was sandy loam. In this experiment, mainly FYM in the form of fresh animal dung was stored in river water continue 2 months in combination with a concentration of $CaCO_3$ (ground lime). After that just before use of this rich material source of nutrient the N at the rate of 100 kg in the form of Urea was mixed together in liquid form material (FYM + $CaCO_3$ + H_2O + $NO_3 \rightarrow$ OC). This sustainable source of nutrient for growth and yield of the sunflower crop was step by step prepared in a certain period. All steps were carefully completed and then final stage we got a solution which was rich in macro and micronutrient, that solution can directly applied in standing crop with the method of Fertigation during the flow of irrigation and also that solution further processed to make dry material. The dry material can directly apply to crop by the method of broadcasting as like other fertilizers other fertilizers are applied in standing crop. The application of OC source of the nutrient in case of solution is more suitable than dry material because of it quick dissolve in irrigation water and drains to available the root zone of the plant. Therefore, self-made OC source of nutrient was applied in liquid form in irrigation water flow. The first doze was applied at second irrigation, and all doses were completed in all irrigation. The irrigation requirement was fulfilled by the requirement of crop plant of sunflower according the climatic conditions. During the weed control, the soft weeds were killed during the each application of self-made OC source of nutrients, those were grown in root zone of plant and would never germinate again at the root zone of crop plant and there were no any side effect noted to the crop plant, again for this reason OC also applied on young cotyledon to observe that it may kill the crop plant of sunflower, but sunflower plants were found safe and healthy. The integrated self-made source of nutrient supplies the nutrients till third irrigation and moisture availability were continuing enhanced by the its applications. The data of growth and yield was collected by the standard procedure and parameter. There are five plants were tagged randomly for the measurement of parameters, which includes plant height cm, stem girth cm, number of leaves plant^{-1}, head diameter cm, seed yield kg/ha were continually recorded till its maturing stage. The height was measured with a meter stick. The weeds were controlled through the traditional methods.

RESULTS AND DISCUSSION

Cultivation of sunflower crop in combination with inorganic along with organic material increased plant height, stem girth, the number of leaves, head diameter, seed yield. The stored well decomposed FYM in water plus concentration with ground lime ($CaCO_3$) and adding of N in a scientific process provides better results in sandy, sandy loam soils and its influence on sunflower plant growth, development and yield were significant. Soil heath and its pH were noted maintained. Moreover FYM releases nutrients rapidly.

Plant Height

The result showed significant effect OC source of the nutrient. The maximum plant height of 140 cm was recorded in treatment T_3 plot in which split dose of 500 kg/ha OC source of nutrient were applied at all irrigation and T_2 in resulted 125 cm plant height, reduced dose 300 kg/ha of OC were applied while lowest plant height 110 cm was recorded in T_1, 200 kg/ha were applied.

Stem Girth

Stem girth is significantly affected by increased level of OC source of nutrients. Results proved that T_3 showed

maximum value 7.60 at 500 kg/ha dose of OC level. Following T_1, the T_2 provided higher value 5.08 (300 kg/ha OC were applied) and highly minimum value were noticed in T_1, in this plot 200 kg/ha OC source of nutrient were applied.

Number of Leave Plant^{-1}

T_3 at application 500 kg/ha rate of OC source of nutrient showed significant number of leaves per plant (16) and T_2 at application 300 kg/ha rate of OC source of nutrient showed competitive result (13) number of leaves plant^{-1}. T_1 was found very a minimum number of leaves plant^{-1} (12) compare to $T_{1.}$

Head Diameter

According to the results the maximum head diameter 15.70 cm was recorded in T_3 plot (500 kg/ha OC source of the nutrient were applied). This is a significant result. Smaller head diameter 9.50 showed by T_1 plot, where 200 kg/haOC source of the nutrient were applied.

Seed Yield

Plot of T_3 showed significant results in term of seed yield was determined 1580.00 kg/ha at 500 kg rate of OC source of nutrients while at the rate of 300 kg/ha OC in T_2 showed some variable value behind T_3. Similarly, T_1 remained behind to the T_2 and produced 1300.40 kg seed yield ha^{-1} at the rate of 200 kg/ha OC source of the nutrient were applied.

Overall statistically results proved that the OC source of nutrients (FYM + $CaCO_3$ + H_2O + NO_3 → OC) is useful for growth and yield of the sunflower crop.

CONCLUSION

It is concluded that the OC source of nutrients (combination of organic and inorganic material) can be sustainable source of nutrient for better growth and yield of sunflower crop and its influence is significant which provides maximum plant height cm, stem girth cm, number of leaves plant^{-1}, head diameter cm, seed yield kg/ha. The responses of sunflower plant were determined good, soil health improved in each application, the moisture availability continually observed on the soil surface and soil pH also remains in balance. However, this experiment suggesting that self-made OC source of nutrient (OC) is most suitable in areas where irrigation water is insufficient and water shortage is a problem including soils having not good water holding capacity as well, such as sandy soils. Moreover, it has a positive effect on the environment, it supports to N_2 fixation bacteria, and maintenances the soil fertility. Through the use of OC source of a nutrient, a farmer is able to supply macro and micronutrients simultaneously and can avoid any nutrient stress.

Table 1: Growth and yield components of sunflower are affected by different levels of self-made organic-chemical source of nutrient (OC)

Treatments (OC levels)	Plant height (cm)	Stem girth (cm)	Leaves (plant^{-1})	Head diameter (cm)	Seed yield (kg/ha)
T_1	110	3.25	12	9.50	1300.40
T_2	125	5.08	13	12.33	1430.77
T_3	140	7.60	16	15.70	1580.00

Result are significantly different at $P<0.05$. OC: Organic-chemical

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