The Pharma Innovation Journal 2023; 12(3): 5891-5893

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 5891-5893

www.thepharmajournal.com
Received: 08-01-2023
Accepted: 11-02-2023

UD Awasthi
Department of Soil Conservation and Water Management, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Dharmveer Verma
Department of Soil Conservation and Water Management, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Anand Kumar
Department of Soil Conservation and Water Management, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Rahul Ranjan
Faculty of Agricultural Sciences and Allied Industries, Rama University, Uttar Pradesh, Kanpur, Uttar Pradesh, India

Anurag Awasthi
Faculty of Agricultural Sciences and Allied Industries, Rama University, Uttar Pradesh, Kanpur, Uttar Pradesh, India

Abhishek Awasthi
Faculty of Agricultural Sciences and Allied Industries, Rama University, Uttar Pradesh, Kanpur, Uttar Pradesh, India

Corresponding Author:
Rahul Ranjan
Faculty of Agricultural Sciences and Allied Industries, Rama University, Uttar Pradesh, Kanpur, Uttar Pradesh, India

Water use efficiency and root development of linseed (*Linum usitatissimum* L.) cultivars as influenced by nutrient management under moisture scarce condition

UD Awasthi, Dharmveer Verma, Anand Kumar, Rahul Ranjan, Anurag Awasthi and Abhishek Awasthi

Abstract
A field experiment was conducted on linseed varieties at varying levels of fertility levels during 2019-20 and 2021-22 at oilseed farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. 15 treatment combinations of 5 cultivars, *viz.* V_1: Indu, V_2: Uma, V_3: Shekhar, V_4: Rajan, V_5: Shubhra and 3 fertility levels *viz.* F_1: RDF (50+40+40 Kg NPK ha^{-1}), F_2: RDN (50+40+40 Kg NPK ha^{-1})-75%+25% through vermicompost) and F_3: RDN- 75% + 25% through vermicompost + 30 Kg Zinc sulphate ha^{-1} in Randomized Block Design with 3 replications. The result revealed that linseed var. Shekhar alongwith RDN – 75%+25% through vermicompost + 30 kg zinc sulphate ha^{-1} showed maximum water use efficiency of 4.51 and 4.85 kg seed ha^{-1} mm^{-1} of water and highest root depth was measured under variety V_3: Shekhar (23.14 and 23.38 cm). The number of roots plant^{-1} and dry weight of roots plant^{-1} (g) showed the similar trend during the two years of observation.

Keywords: Vermicompost, rainfed, root development, water use efficiency

Introduction
In India it is not only important to increase the availability of water but also efficient utilization of water but also efficient utilization of water should be promoted by adopting other techniques of proper soil and crop management and cultivating crops based on and suitability is the first and most important factor which can reduce soil and water management problems. In recent years, increase in agricultural production results at the expense of deterioration in the natural resource base partly on which farming systems depend. So, it is utmost important that this trend be reversed by encouraging farmers to adopt more and sustainable methods that will have long term benefits in environmental conservation and development of livelihoods. Soil is fundamental requirement for crop production as it provides plants with water and nutrients. Therefore maintenance and improvements of soil quality in continuous cropping systems is very important for sustaining agricultural productivity (Binjola *et al.*, 2017) [4]. Efficient nutrient management under environment friendly condition is crucial to increase crop production worldwide. Appropriate use of chemical fertilizers onto soils reduced greenhouse gas emissions. (Baishya *et al.*, 2016) [3]. Nutrient management practices include both crop and soil fertilization refers to fertilizer application according to the crop need while soil fertilization is targeted to replenish its fertility level.

Water is scarce resource and quantity of water required for maximum crop production is inadequate. Improving water efficiency in irrigated agriculture is thus priority for better environmental and economic performance. The farmers intend to use the maximum water for irrigation, this method even in the case of no limitation with water resources, does it seems to be logical. Under such condition, it is required that the water use efficiency (WUE) be optimized in the field. When crop water requirement is not met, the crop encounters water stress, as a result, crop yield is reduced. (Agrawal *et al.*, 2017) [2].

Water is life because humans, plants and animals cannot live without water. Water is needed to ensure food security, feed livestock and take up industrial production and to conserve biodiversity and environment. Due to growing human population, severe neglect and over exploitation of this resource, water is becoming a scarce commodity. Farmers of India have been traditionally practicing flow irrigation which is resulting in huge wastage of water, while causing severe erosion, leaching of nutrients, increasing the infestation of pests, diseases and weeds and suppressing of crop yields. (Tirkey *et al.*, 2017) [7].

Thus, the present investigation was undertaken to meet the urgent need of the farmers of central alluvial soil of Uttar Pradesh.

Materials and Methods

An experiment was conducted under rainfed condition during 2019-20 and 2021-22 at oilseed Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Kanpur is situated in the Central part of Uttar Pradesh at an elevation of 129 meters above sea level. It lies between 25^0 26’ and 26° 58’ North latitude and 79^0 31’ and 80^0 34’ East longitude. The experimental area falls in the sub tropical zone having semi-arid climate. The average annual rainfall is about 800 mm. The soil of the experimental field was sandy loam in texture having low organic carbon and available nitrogen. Available phosphorus and potassium status of soil was medium. The experiment was laid out in Randomized Block Design replicated thrice comprising 15 treatment combinations. Five linseed cultivars *viz.* V_1: Indu, V_2: Uma, V_3: Shekhar, V_4: Rajan, V_5: Shubhra and three fertility levels *viz.* F_1: RDF 50+40+40+ NPK ha^{-1}, F_2: RDN (50+40+40 NPK ha^{-1}) 75%+25% through vermicompost) and F_3:RDN – 75%+25% through vermicompost+ 30 kg zinc sulphate ha^{-1}. Row to row and plant to plant spacing were kept 25 and 10 cm respectively. Crop was sown on 19.11.2019 and 13.11.2021 during first and second year, respectively.

Recommended dose of NPK were applied at the time of sowing through urea, diammonium phosphate and murate of potash respectively. Water use efficiency in terms of production of seeds per unit of water used in different treatments were estimated from the equation given by (Viets, 1962). WUE=Y/ET, where, WUE= Water Use Efficiency kg seed ha^{-1} mm^{-1} of water, Y= Yield of seed (kg ha^{-1}), ET= Evapotranspiration. Root studies were made only at maturity stage. For this purpose three plants of each treatments were selected randomly. A pit of around 30 cm around the plant shoot up to 40 cm depth was dug, then each root was opened by washing off the adhered soil with the help of fine jet spray of water. The exposed roots were finally washed in running water keeping them in a sieve. The observations regarding depth of root, roots $plant^{-1}$ and dry weight of roots $plant^{-1}$ were recorded. Plant roots were counted and mean of 3 plant roots in each plot was recorded as number of root $plant^{-1}$. After counting the number of roots it was kept in bamboo paper bags which were sundried for few days and then transferred to oven at 50 °C$\pm$1 for two hours. Then their weight was recorded on electronic balance. The mean of three plants were computed and recorded as dry weight of roots $plant^{-1}$.

Results and Discussion

Water use

The data on water use under different treatments were estimated and presented in Table 1 for both the years of experimentation. The data clearly reveals that among linseed cultivars highest water use of (300 and 296 mm) was obtained by cv. Shekhar followed by cv. Rajan and lowest under V_1: Indu (288 and 286 mm) during the first and second year of observation, respectively. Verma *et al.*, (2019) [10].

WUE

The data clearly reveal that water use efficiency was found to vary effectively due to different varieties of linseed. The treatment of cv. Shekhar (V_3) showed veraciously highest value of 4.51 and 4.85 kg seed ha^{-1} mm^{-1} of water and lowest WUE of 2.88 and 4.06 kg seed ha^{-1} mm^{-1} of water was recorded in the treatment of cv Indu (V_1) during both the years. Yadav and Uttam (2010) [11].

It is clear from the data that increasing levels of fertility levels increased the water use efficiency, considerably. The treatment of F_3: RDN – 75%+25% through vermicompost+ 30 kg zinc sulphate ha^{-1} showed highest value of 5.37 and 4.66 kg seed ha^{-1} mm^{-1} of water during the two different years of experimentation. These results are in accordance with those of Diwan *et al.*, (2019) [5].

Table 1: Effect of varieties at varying levels of fertilizer on water use and water use efficiency under different treatments

Treatments	Water Use (mm)		Water use efficiency (kg seed ha^{-1} mm^{-1} of water)	
	2019-20	2021-22	2019-20	2021-22
Varieties				
V_1: Indu	288.3	286.5	4.31	4.06
V_2: Uma	290.9	293.2	4.42	4.33
V_3: Shekhar	300.2	296.3	4.51	4.85
V_4: Rajan	294.2	291.2	4.45	4.61
V_5: Shubhra	292.1	292.4	4.46	4.58
Fertility levels				
F_1: RDF (50+40+40 Kg NPK ha^{-1})	290.6	285.9	4.62	4.28
F_2: RDN (50+40+40 Kg NPK ha^{-1})- 75%+25% through vermicompost)	293.1	293.3	5.03	4.51
F_3: RDN- 75% + 25% through vermicompost + 30 Kg Zinc sulphate ha^{-1}	295.3	296.6	5.37	4.66

Root development

The data regarding root depth (cm) Table-2 reveals that highest root depth was measured under V_3 Shekhar (23.38 cm) followed by V_4: Rajan (22.49 cm) and lowest under variety V_1: Indu (21.03 cm) for root depth of linseed. Among different fertility levels the maximum root depth (cm) was observed under fertility level F_3: RDN- 75% + 25% through vermicompost + 30 Kg Zinc sulphate ha^{-1} followed by fertility level F_2: RDN (50+40+40 Kg NPK ha^{-1})- 75%+25% through vermicompost) and minimum values under F_1: RDF (50+40+40 Kg NPK ha^{-1}) during the two years of experimentation.

Furthermore, data regarding number of roots $plant^{-1}$, the maximum number of roots $plant^{-1}$ was measured under V_3: Shekhar followed by V_4: Rajan and lowest under V_1: Indu for different varieties of linseed. Among different fertility levels the highest number of roots $plant^{-1}$ was observed under fertility level F_3: RDN – 75%+25% through vermicompost+ 30 kg zinc sulphate ha^{-1} followed by fertility level F_2: RDN (50+40+40 NPK ha^{-1}) 75%+25% through vermicompost) and minimum under fertility F_1 for number of roots plant^{-1} during the two different years. Similar observations have been recorded by Awasthi *et al*., (2019) [1] and Verma *et al*., (2017) [9].

Table 2: Effect of varieties at varying levels of fertilizer on root development under different treatments

Treatments	Root depth (cm)		No. of roots plant^{-1}		Dry weight of roots plant^{-1}(g)	
	2019-20	2021-22	2019-20	2021-22	2019-20	2021-22
Varieties						
V_1: Indu	21.56	21.03	23.98	23.04	2.07	2.23
V_2: Uma	21.97	22.01	24.65	24.92	2.18	2.49
V_3: Shekhar	23.14	23.38	25.54	26.23	2.87	2.65
V_4: Rajan	22.25	22.49	24.98	25.61	2.64	2.54
V_5: Shubhra	21.54	21.93	24.07	24.02	2.54	2.52
Fertility levels						
F_1: RDF (50+40+40 Kg NPK ha^{-1})	22.67	21.57	25.78	25.65	2.60	2.36
F_2: RDN (50+40+40 Kg NPK ha^{-1})- 75%+25% through vermicompost)	23.78	22.02	25.90	26.03	2.65	2.49
F_3: RDN- 75% + 25% through vermicompost + 30 Kg Zinc sulphate ha^{-1}	24.80	23.42	26.12	26.42	2.69	2.67

The data regarding dry weight of roots plant^{-1} (g) showed the highest value of roots plant^{-1} was recorded under V_3: Shekhar (2.65 g) followed by V_4: Rajan (2.54 g) and lowest under cv V_1: Indu. Among different fertility levels the highest weight of root plant^{-1} (g) was observed under F_3 followed by fertility level F_2 and lowest under F_1 during the two years of experimentation. These results were in close conformity with the findings of Kumar *et al*., (2018) [6] and Diwan *et al*., (2019) [5].

Conclusion

Based on the results of the experiment, it could be concluded that the variety Shekhar with application of RDN – 75%+25% through vermicompost+ 30 kg ha^{-1} zinc sulphate ha^{-1} proved to be best in respect of seed yield, water use efficiency and C:B ratio may be recommended invariably to practice under rainfed alluvial tract of Uttar Pradesh.

References

1. Awasthi UD, Dubey SD, Shripal. Effect of nitrogen and moisture conservation practices on yield, uptake, water use efficiency and quality of linseed. Indian journal of Agricultural Sciences. 2011;81(4):383-385.
2. Agrawal Puroshottam, Verma MK, Sinha J, Nigam GK. Optimization of canal irrigation scheduling for kharif crops in Mahanadi Command area, Chattisgarh. Journal of Soil and Water Conservation. 2017;16(1):59-66.
3. Baishya LK, Sarkar D, Ansari MA, Walling I, Thakuria RK. Effect of different sources of organic manures and inorganic fertilizers on productivity of rice (*Oryza sativa* L.) and soil health. Indian Journal of Soil Conservation. 2016;44(3):284-289.
4. Binjola Sonam, Grewal KS, Antil RS. Long term effect of organic manures and fertilizers on periodic changes of phosphorus fractions in soils under wheat. Journal of Soil and Water Conservation. 2017;16(1):86-90.
5. Diwan D, Sirothia P, Dwivedi AK. The interaction effect of sulphur and zinc on yield of linseed crop. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):2047-2050.
6. Kumar S, Phogat M, Lal M. Response of Pulse and Oilseed Crops to Boron Application: A Review. International Journal of Current Microbiology and Applied Sciences. 2018;7(03):669-675.
7. Tirkey SR, Sherring Arpan, Kumar M. Development of mathematical model for estimation of wetting front advance under drip irrigation in sandy loam soil. Journal of Soil and Water Conservation. 2017;16(1):53-58.
8. Viets FG. Fertilizers and efficient use of water. Advances in Agronomy. 1962;14:223-264.
9. Verma, Amar Kant, Yadav PN, Awasthi UD. Studies on linseed (*Linum usitatissimum* L.) based intercropping systems as influenced by integrated nutrient management on yield and economics under moisture scarce condition. International Journal of Current Microbiology and Applied Sciences. 2017;6(11):2309-2314.
10. Verma, Amar Kant, Yadav PN, Awasthi UD, Ranjan R, Singh GD. Response of root development and quality parameters on linseed (*Linum usitatissimum* L.) based cropping systems as influenced by integrated nutrient management under rainfed condition. Bulletin of Environment, Pharmacology and Life Sciences. 2019;8(6):96-100.
11. Yadav PN, Uttam SK. Moisture conservation practices and fertility levels on growth behavior, water use efficiency and yield of lentil in rainfed condition. Journal of Soil and Water Conservation. 2010;9(2):20-122.