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PS Gochar

M.Sc. Scholar, Department of Agronomy, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

RP Andhale

Associate Professor, Department of Agronomy, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India.

SK Surendra

Ph.D. Scholar, Division of soil Science and Agricultural Chemistry, ICAR-Indian Agriculture Research Institute, New Delhi, India

R Gurjar

M.Sc. Scholar, Department of Soil Science and Agricultural Chemistry, S.K.N. College of Agriculture, SKNAU, Jobner, Jaipur, Rajasthan, India

The effect of sowing windows on the soil chemical properties after harvest of *summer* soybean

PS Gochar, RP Andhale, SK Surendra and R Gurjar

Abstract

A soybean field experiment was conducted in the *summer* of 2022 at Post Graduate Institute Research Farm, MPKV, Rahuri. The findings showed that, the highest available organic carbon and nitrogen, phosphorus, potassium were found in case of 7th MW sowing and highest pH, EC were found in case of 1st MW sowing during year of investigation and among four varieties highest available organic carbon and nitrogen, phosphorus, potassium were found in JS-9305.

Keywords: Sowing windows, *summer*, soybean, organic carbon, nitrogen, phosphorus, potassium

1. Introduction

Soybean is the number one oil seed crop in terms of oil production in the world. When compared to pulse crops, which are the main source of dietary protein, soybean yields are two to three times higher. In addition to a high concentration of calcium, phosphorus, vitamins, and important amino acids like lysine (5%), soybean seeds contain 40–45% protein, 20–22% oil, and 20–26% carbohydrates (Rahman *et al.*, 2011) [6]. It is referred to as the "gold of soil" or the "golden bean" because it can keep soil fertile by fixing atmospheric nitrogen in the soil. It is a crop with three distinct benefits: it provides a special food, excellent feed, and a raw material with significant industrial potential (Gurav *et al.*, 2022) [1]. Soybean increases soil fertility by incorporating 0.5 to 1.5 t ha⁻¹ of organic matter and fixing 45 to 60 kg per hectare of atmospheric nitrogen using root nodules (Kanase *et al.*, 2006) [3].

2. Material and Methods

At the Mahatma Phule Krishi Vidyapeeth Post Graduate Institute Research Farm in Rahuri, M.S., a field experiment was undertaken in the *summer* of 2022. The experiment was conducted to evaluate the impact of sowing windows on soil pH, EC, organic carbon, and nutrients readily available.

The experiment was set up using a split plot design with four sowing windows *viz.*, first, third, fifth, and seventh meteorological week as the main plot and four varieties of soybean *viz.*, JS-9305, Phule Kimaya (KDS-753), Phule Sangam (KDS-726) and Phule Durva (KDS-992) as the sub plot. The experiment was replicated three times. The crop was evenly fertilized with recommended amount of 75 kg nitrogen 45 kg phosphorus and 50 kg potassium and 6 tonnes vermicompost per hectare.

Soil Analysis

Taking the composite soil sample from the testing region 0–30 cm layer of soil prior to sowing. After harvest, soil samples from each treatment were taken in order to evaluate its chemical qualities. The correct estimate techniques were applied, and a calculation was made of the amount of these nutrients present in the soil samples. These observations were used to calculate the nutrients' availability per hectare.

3. Results and Discussion

Effect of sowing windows

The pH, EC (dSm²), OC (%) and available residual nitrogen, phosphorus and potassium (kg ha⁻¹) content in soil did not differ significantly due to sowing windows. The highest N, P and K in soil were found in 7th MW sowing (251, 20.0 and 370 respectively) due to delayed sowing resulting into short life cycle of crop and poor uptake of nutrients. The same findings were also reported by Sheshama *et al.* (2017) [7].

Corresponding Author:

PS Gochar

M.Sc. Scholar, Department of Agronomy, Post Graduate Institute, MPKV, Rahuri, Maharashtra, India

Table 1: Initial soil chemical properties and methods used to estimate the soil chemical properties.

S. N	Particulars	Results	Method adopted	Reference
A.	Chemical composition			
1.	Organic carbon (%)	0.51	Wet oxidation method	Nelson and Sommer (1982)
2.	Available N (kg ha ⁻¹)	230	Alkaline permanganate with 0.32% KMnO ₄	Subbiah and Asija (1956) ^[8]
3.	Available P ₂ O ₅ (kg ha ⁻¹)	18.2	Olsen method with 0.5 M NaHCO ₃ (pH 8.5)	Watanabe and Olsen (1965) ^[4]
4.	Available K ₂ O (kg ha ⁻¹)	368	Ammonium acetate extraction with NH ₄ OAc	Jackson (1973) ^[2]
5.	Soil pH (1:2.5 soil water suspension)	7.6	Potentiometric	Jackson (1973) ^[2]
6.	Electrical conductivity (dSm ⁻¹)	0.30	Conductometric	Jackson (1973) ^[2]

Effect of varieties

The pH, EC (dSm²), OC (%) and available residual nitrogen, phosphorus and potassium (kg ha⁻¹) content in soil were non-

significant due to varieties. Among all the soybean varieties highest nitrogen, phosphorus and potassium in soil were found in JS-9305 (245, 19.2, 368, respectively)

Table 2: pH, EC (dSm-2), OC (%), and available N, P, K (kg ha-1) content in the soil after harvest of summer soybean.

Treatments	pH (1:2.5 Soil: water suspension)	OC (%)	EC (dSm ²)	N (Kg ha ⁻¹)	P (Kg ha ⁻¹)	K (Kg ha ⁻¹)	
A.	Main plot: Sowing windows (S)						
S ₁ :	1 st MW (1 st Jan.-7 th Jan.)	7.8	0.46	0.33	240	16.8	358
S ₂ :	3 rd MW (15 th Jan.-21 st Jan.)	7.7	0.46	0.32	236	16.7	349
S ₃ :	5 th MW (29 th Jan.-04 th Feb.)	7.7	0.48	0.32	244	19.1	367
S ₄ :	7 th MW (12 th Feb.-18 th Feb.)	7.6	0.49	0.31	251	20.0	370
	S.Em. ±	0.1	0.01	0.01	7.4	0.8	5.3
	C.D. at 5%	NS	NS	NS	NS	NS	NS
B.	Sub plot: Varieties (V)						
V ₁ :	JS-9305	7.7	0.48	0.31	245	19.2	368
V ₂ :	Phule Kimaya	7.7	0.47	0.32	242	17.8	362
V ₃ :	Phule Sangam	7.7	0.48	0.33	242	18.0	357
V ₄ :	Phule Durva	7.6	0.47	0.33	241	17.5	356
	S.Em. ±	0.1	0.01	0.01	5.9	0.6	8.6
	C.D. at 5%	NS	NS	NS	NS	NS	NS
C.	Interaction (S × V)						
	S.Em. ±	0.3	0.02	0.02	11.9	1.3	17.3
	C.D. at 5%	NS	NS	NS	NS	NS	NS
	CV %	8.7	8.8	10.8	8.5	12.6	8.3
	General Mean	7.7	0.47	0.32	243	18.1	361
	Initial value	7.6	0.51	0.30	230	18.2	368

4. Conclusion

The highest values for available nitrogen (251 kg ha⁻¹), phosphorus (20.0 kg ha⁻¹) and potassium (370 kg ha⁻¹) content of soil after harvest of *summer* soybean was recorded under 7th MW sowing and the highest values for available nitrogen (245 kg ha⁻¹), phosphorus (19.2 kg ha⁻¹) and potassium (368 kg ha⁻¹), in soil after harvest was recorded with variety JS-9305.

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