EFFECT OF NUTRIENTS OMISSION ON GROWTH, YIELD AND ECONOMICS OF RABI SORGHUM(*Sorghum bicolor* L.) IN VERTISOLS UNDER RAINFED CONDITIONS

Abstract

A field experiment was conducted at Agricultural Research Station, Tandur, Professor Jayashankar Telangana State Agricultural University during 2020-21 and 2021-22 to study the impact of nutrient omission on productivity and profitability of *Rabi* sorghum.The experiment was laid out in randomized block design with 3 replications. Pooled data results indicated thatamong the nutrient omissions treatments, significantly higher plant height (211.7 cm), Days to 50% flowering (75 days), panicle length (17.9 cm), number of grains panicle^{-1}(946), grain yield (1234 kg ha^{-1}), fodder yield (5788 kg ha^{-1}), harvest index (18.17), net returns of Rs. 44,790 ha^{-1} and BC ratio of 2.68 were recorded in no omission treatments and it was on par with K omission followed by N omission and lowest with NPK omission (control) treatments. When compared to the no omission (NPK) treatment, the *rabi* sorghum grain yields were decreased 2% with the K omission, 10% with N omission, 15% with P omission, 22% with PK omission, 23% with NK omission, 29% with NP omission and 39% with NPK omission.

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Keywords: Nutrient omission, Rabi Sorghum, Growth, Yield

Introduction

Rabi sorghum is valued mainly as staple food of humans in rainfed ecosystem and fodder for livestock. In India, *Rabi* Sorghum is cultivated in an area of 27.35 lakh ha with a production of 28.25lakh tons and productivity of 1033 kg ha^{-1}. In Telangana, this crop occupies an area of 0.48lakh ha with a production 1.20lakh tons and an average yield of 1711 kg ha^{-1} (INDIASTAT, 2020-21).The production and productivity of this crop is restricted by insufficiency of present fertilizer recommendations, low fertilizer efficiency, no application of micronutrients and continuous deterioration of soil quality. Adequate supply of plant nutrients decides optimum productivity of any crop or cropping system. All other factors of crop production are in the optimum, the fertility of a soil largely determines the ultimate yield. When the soil does not supply sufficient nutrients for normal plant development and optimum productivity, application of supplemental nutrient is required. Since soil reserves alone are not sufficient to meet the nutrient requirement of the crop, a balance nutrient supply has to be provided keeping in view of the soil inherent nutrient supplying capacity to achieve higher crop yields (Das *et al.*, 2014). Fertilizer is one of the most important sources to meet the target yield. Indiscriminate use of fertilizers may cause adverse effect on soils and crops both nutrient toxicity and deficiency either by over use or inadequate use. Thus the current investigation was designed to determine the effect of nutrient omission under rainfed condition on growth and yield parameters of *rabi* sorghum.

Materials and Methods

A field experiment was conducted at Agriculture Research Station, Tandur, Professor Jayashankar Telangana State Agricultural University for two years 2020-21 and 2021-22. The soil of the experimental field was clayey in texture, low in organic carbon (0.26 %), low in available nitrogen (225 kg ha^{-1}), high in available phosphorus (22 kg ha^{-1}), high in available potassium (532 kg ha^{-1}) and slightly alkaline in reaction (pH 6.79). The recommended dose of NPK for Rabi sorghum was 60:40:40 (NPK kg ha^{-1}). An experiment was laid out in randomized block design by comprising eight treatments plots 1. T_1: No Omission (NPK), T_2: N omission (PK), T_3: P omission (NK), T_4: K omission (NP), T_5: NP Omission (K), T_6: NK Omission (P), T_7: PK omission (N) and T_8: NPK omission (control)with 3 replications. Rabi Sorghum was sown CSV-29 R was with spacing of 45 cm x 10 cm in second fortnight of October and harvested in second fortnight of February during two years. Net plot yield was converted into hectare basis. The results were analyzed using standard statistical procedure given by Panse and Sukhatme (1967).

Result and Discussion

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Growth parameters

Significantly maximum plant height (211.7 cm) was recorded with No omission (NPK) treatment and it was on par with K omission (NP) followed by N omission (PK) treatment. There was no significant different of number of plants m^{-2}(Table.1).The increase in the plantheight availability of adequate nutrient supply. The results were similar to Joshi *et al.,* (2016)reported that growth were significantly influenced by nutrient omission.

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Yield Attributes

Significantly higher panicle length (17.9 cm) and number of grains (946) were recorded without omission (NPK) and it was on par with K omission (17.7 cm) followed by N omission. There was nosignificance difference of test weight among the treatments (Table.2).The panicle length and number of grains $panicle^{-1}$ might be due to better photosynthates and translocation of nutrients(Mohammed *et al.,* 2022)

Comment [h4]: Improvement or reduction in panicle length and number of grains per panicle???

Grain and Stover Yield

The highest grain yield (1234 kg ha^{-1}) and fodder yield (5788 kg ha^{-1}) were recorded with no omission treatment (NPK) and it was on par with K omission (NP), N omission (PK) and P omission (NK). Compared to the no omission (NPK) treatment, the rabi sorghum grain yields were decreased 2% with the K omission, 10% with N omission, 15% with P omission, 22% with PK omission, 23% with NK omission, 29% with NP omission and 39% with NPK omission. The highest fodder yield (5788 kg ha^{-1}) was recorded with no omission treatment (NPK) and lowest in NPK omission (Control) treatment (Table.3). Compared to the no omission (NPK) treatment, the *rabi* sorghum fodder yields were decreased 0% with the K omission, 6%

with P omission, 7% with N omission, 17% with PK omission, 21% with NP omission, 23% with NK omission and 35% with NPK omission. The highest harvest Index was also followed same trend.Omission of P and K resulted in 12.4 and 17.5% reduction in grain yield, respectively in wheat (Ekta et al., 2018).

Economics

Maximum net returns of Rs. (44,790 ha^{-1}) with BCR of 2.68 was recorded in no omission (NPK) treatment (Table.4). The improvement in economic returns was mainly due to higher grain and fodder yields. Hargilas,2019 reported that nitrogen and phosphorus were proved to be the most limiting nutrient in crop production.

Conclusion

Results indicated that highest growth, yield attributes, yield and economics of *rabi*sorghum were recorded with no omission (NPK) and lowest with NPK omission plots (Control). Omission of K followed by N and P has less reduction in all growth parameters and yield. Omission of PK followed by NK and NP has significantly recorded more reductions in all growth parameters and yield.

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Comment [h5]: Better to use abbreviation throughout the document after mentioning first

Comment [h6]: Enclose in bracket

Comment [h7]: N and P… use abbreviation

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Table:1. Effect of nutrition omission on growth parameters of Rabi Sorghum

Treatments	Plant height (cm)			No. of plants m^{-2}			Days to 50 % flowering		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1: No omission (NPK)	213.0	210.3	211.7	18	19	19	75	75	75
T2: N omission (PK)	193.0	190.0	191.5	16	18	17	74	74	74

T3: P omission (NK)	188.7	187.3	188.0	15	17	17	74	74	74
T4: K omission (NP)	208.7	206.0	207.3	17	20	19	74	74	74
T5: NP omission (K)	178.3	176.0	177.2	15	16	16	73	73	73
T6: NK omission (P)	170.3	168.3	169.3	14	16	16	71	71	71
T7: PK omission (N)	174.7	172.3	173.5	15	17	16	71	71	71
T8: NPK omission (Control)	164.7	162.1	163.4	14	16	16	69	69	69
SEm±	9.55	9.87	9.69	1.15	1.45	1.32	0.55	0.55	0.55
C.D. (p=0.05)	20.69	21.37	21.00	2.50	NS	NS	1.19	1.19	1.19
CV (%)	6.28	6.57	6.41	9.06	10.14	9.57	0.93	0.93	0.93

Table: 2. Effect of nutrition omission on yield attributes of Rabi Sorghum

	Panicle length (cm)			**No. of grains panicle^{-1}**			**Test wt (gm)**		
Treatments	**2020-21**	**2021-22**	**Pooled**	**2020-21**	**2021-22**	**Pooled**	**2020-21**	**2021-22**	**Pooled**
T1: No omission (NPK)	17.9	17.8	17.9	940	951	946	42.7	42.8	23.6
T2: N omission (PK)	16.7	16.7	16.7	908	866	887	41.4	41.8	23.0
T3: P omission (NK)	16.4	16.4	16.4	855	916	886	40.7	41.1	22.6
T4: K omission (NP)	17.7	17.7	17.7	917	926	922	43.7	44.0	24.2
T5: NP omission (K)	16.0	16.0	16.0	811	827	819	39.1	39.4	21.7
T6: NK omission (P)	15.7	15.7	15.7	788	803	796	38.4	38.7	21.3
T7: PK omission (N)	15.7	16.1	15.9	792	806	799	35.9	45.9	24.7
T8: NPK omission (Control)	14.1	13.3	13.7	547	558	553	33.3	33.7	18.5
SEm±	0.67	0.611	0.59	50.07	49.736	47.311	2.84	4.52	1.65
C.D. (p=0.05)	1.45	1.32	1.28	108.44	107.71	102.45	NS	NS	Ns
CV (%)	5.02	4.61	4.44	7.48	7.33	7.02	12.59	13.51	12.77

Table: 3. Effect of nutritionomission on yield of Rabi Sorghum

	Grain Yield (kg ha^{-1})			**Fodder Yield (kg ha^{-1})**			**Harvest Index (%)**		
Treatments	**2020-21**	**2021-22**	**Pooled**	**2020-21**	**2021-22**	**Pooled**	**2020-21**	**2021-22**	**Pooled**
T1: No omission (NPK)	1232	1237	1234	6206	5370	5788	16.76	19.58	18.17

T2: N omission (PK)	1039	1188	1114	5320	5471	5395	16.30	18.12	17.22
T3: P omission (NK)	954	1154	1053	5249	5587	5418	15.41	16.84	16.13
T4: K omission (NP)	1134	1294	1214	5720	5853	5786	16.58	17.44	17.01
T5: NP omission (K)	906	853	880	5029	4109	4569	15.27	17.55	16.41
T6: NK omission (P)	859	1032	946	4461	4505	4483	16.17	18.79	17.48
T7: PK omission (N)	900	1023	961	4768	4851	4810	15.96	16.86	16.41
T8: NPK omission (Control)	797	805	801	3904	3653	3779	16.96	18.22	17.59
SEm+	66.72	185.00	99.87	366.88	826.97	418.21	-	-	-
C.D. (p=0.05)	144.50	NS	216.28	794.51	NS	905.67	-	-	-
CV (%)	8.35	21.11	11.93	8.84	20.56	10.24	-	-	-

Table: 4. Effect of nutrition omission on economics of Rabi Sorghum

Treatments	Gross returns (Rs ha^{-1})			Net returns (Rs ha^{-1})			BCR		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1: No omission (NPK)	64849	58194	61522	47349	42231	44790	2.71	2.65	2.68
T2: N omission (PK)	54992	47308	51150	38452	30928	34690	2.32	1.90	2.11
T3: P omission (NK)	51747	45076	48411	36697	29193	32944	2.44	1.86	2.15
T4: K omission (NP)	59716	55441	57579	43416	39878	41647	2.67	2.56	2.61
T5: NP omission (K)	49327	42164	45745	35237	27338	31287	2.50	1.84	2.17
T6: NK omission (P)	45687	34870	40279	30347	20363	25355	1.98	1.40	1.69
T7: PK omission (N)	48184	39360	43772	34334	25350	29842	2.48	1.80	2.14
T8: NPK omission (Control)	41568	32576	37072	28678	18149	23414	2.22	1.26	1.74