

EFFECT OF PHOSPHORUS AND POTASSIUM FERTILIZERS ON THE GROWTH AND YIELD OF BERSEEM (*Trifolium alexandrinum* L)

M. Rasheed and F. Ahmad

¹Research Officer Fodder Crops Livestock Production Research Institute Bahadurnagar Okara.

²Superintendent Livestock Experiment Station Qadarabad (Sahiwal)

Corresponding Author Email address: -mruaf@yahoo.com.

ABSTRACT. A research study was conducted to find out the effect of phosphorus and potassium fertilizers on the growth and yield of Berseem (*Trifolium alexandrinum* L) which belongs to the family Papilionaceae. The experiment was conducted at LPRI, Bahadurnagar Okara in the Field area of Fodder Crops Division during Rabi 2021-22 to 2023-24. The experiment was carried out in randomized complete block design (RCBD) with three replications. Treatments including phosphorus (0, 30, 50 and 90 kg P ha⁻¹) and potassium (0, 30 and 60 kg K ha⁻¹) were applied to Berseem fodder crop. These treatments produced significant effect on green fodder yield (ton/ha⁻¹) the Number of tillers per plant, plant height, Number of leaves per plant, number of heads (m⁻²), number of seeds head⁻¹, seed yield (kg ha⁻¹) and thousand seed weight (g). The first cut of the crop was taken after 60 days of sowing. Maximum number of heads (2800 m⁻²), number of seeds head⁻¹ (59.47), green fodder yield (111 Ton ha⁻¹), seed yield (254.45 kg ha⁻¹) and thousand seed weight (2.35 g) were recorded in plots having 90 kg P ha⁻¹ x 60 kg K ha⁻¹, while minimum number of seeds (1732 m⁻²), number of seeds head⁻¹ (37.52), green fodder yield (76 Ton ha⁻¹), seed yield (240.48 kg ha⁻¹) and thousand seed weight (2.08 g) were obtained from plots having no fertilizers (control or 0 kg ha⁻¹). The plant samples were analyzed for quality parameters such as dry matter yield kg per ha⁻¹, DM%, CP%, CF%, and ether Extract. The better-quality fodder i.e. dry matter yield 6.45 ton per ha⁻¹, DM 59.47 %, CP 16.26 %, CF 28.65 %, and ether Extract 1.9% were found in plots having treatment 90 kg P ha⁻¹ x 60 kg K ha⁻¹. The findings of this study shows that berseem had better performance in terms of seed production when fertilized with 90 kg P ha⁻¹ and 60 kg K ha⁻¹ in irrigated areas.

Key words: Berseem, green fodder yield, seed production, phosphorus, potassium.

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INTRODUCTION

Berseem is important Rabi fodder of Pakistan and is sown at an area of 78% among all other Rabi fodders sown. Fodder crop area of Pakistan is 2.11 million hectare and production is 45.77 million tons. It accounts for 3.2 percent in the value added in agriculture and 0.7 percent of GDP. Berseem is the largest Rabi (winter) season cattle fodder grown in the country, 88 per cent of which grows in Punjab, 9 per cent in Sindh, two per cent in the NWFP and 0.5 per cent in Baluchistan. Some Berseem varieties have the potential to boost fodder yields 2 to 3 times when compared to existing varieties (Sing *et al* 1999). It is a popular fodder for milch animals. It provides superior and cheap nutrition for prolonged period to the cattle and helps in enhancing milk production. To add to this, it is a legume fodder and therefore adds nutrients essential to maintain soil fertility and productivity. Berseem contains 18.3% protein, 2.80% P, 2.60% Ca and 209-ppm carotene (precursor of Vit A) at green stage.

Production of Berseem seed is neglected by farmers, government organizations and private sectors

(Dost 1997). Needless to say that the critical constraint for profitable livestock production in developing countries is related to inadequacy of quality forage which is further being aggravated by increased urbanization and enhanced shifting trend of agriculture towards cash crops which further reduces the area under fodder crops. Moreover in our region, low per acre fodder yield coupled with two important fodder scarcity periods (one during summer and other during winter months), which, further aggravated the fodder availability situations. Among major limiting factors which lowers Berseem yield are less use of P and K fertilizer by the farming community which results in low green fodder yield of Egyptian clover. The result of this study provides information to the farming community for obtaining maximum fodder and seed yield from Berseem crop. In many areas of Pakistan, there is shortage of fodder for livestock and available fodder not good quality. Phosphorous is one of the most important nutrient after nitrogen (Munir *et al* 2004). Role of Phosphorous increase plant height, stem diameter, green fodder and seed yield (Khalid *et al* 2003). Berseem fodder plays an important role in livestock production, especially in

tropical zone where fodder can not meet the requirement of livestock (Pholsen and Suksri 2007) but its shortage due to no or less use of P and K fertilizers is the major limiting factor in Pakistan..

Keeping in view the above problem the present study was planned to determine the effect of phosphorous and potassium fertilizers on the growth and yield of Berseem (*Tifolium alexandrium* L) with the following objectives.

1. Assess the green fodder and seed yield of Berseem crop.
2. Assess the role of Phosphorus and Potassium fertilizers in improving the quality of Berseem fodder.
3. Assist the rate/combination of Phosphorus and Potassium for recommendation to the end users.

MATERIALS AND METHODS.

Site Description and Soil Sampling: A three years field experiment was conducted over three growing seasons from 2020 to 2023 at LPRI, Bahadurnagar Okara (Pakistan). The latitude of Okara, Punjab, Pakistan is 30.808500, and the longitude is 73.459396. Okara, Punjab, Pakistan is located at Pakistan country in the Cities place category with the gps coordinates of 30° 48' 30.6000" N and 73° 27' 33.8256" E. The coldest months are December to February, when temperatures may drop to 3 °C (37 °F), with moderate rainfall. The hottest months are May to July, when temperatures may reach 45 °C (113 °F). The annual average rainfall in the city is approximately 509 mm (20.0 inch) (www.google.com/search/geographicl/okara/pakistan.)

Composite soil samples (five random core samples from each plot, thoroughly mixed together) were collected from the surface layer (0–20 cm) from each plot before sowing the crop for physical and chemical soil properties i.e., Soil texture, Organic Matter, Phosphorus, Potassium, CaCO₃, EC, pH, and CEC determination (U.S. Salinity Lab. Staff. 1954).

The experimental area was divided into three equal plots measuring four kanal each. In each four kanal of plot the seed of Berseem fodder crop was broad casted @ 20 Kg ha⁻¹ in a randomized complete block design. After thirty days of sowing the layout was prepared. The Urea fertilizer @ rate of 62 kg ha⁻¹ in each plot and the Phosphorus @ 0, 30, 50 and 90 kg ha⁻¹ in the form of DAP (Di-Ammonium Phosphate) and Potassium @ 0, 30 & 60 kg ha⁻¹ in the form of SOP (Sulphate of Potash) and in various possible combinations were broad casted.

After application of fertilizers the crop was irrigated with canal water. The crop was harvested after 60 days of sowing. The physical data green fodder yield (Kg per ha⁻¹), Number of tillers per plant, plant height and Number of leaves per plant were recorded subsequently after each cut. The plant samples were

collected to analyze for dry matter yield kg per ha⁻¹, Moisture contents %, DM%, CP%, Ash %, CF%, Phosphorus %, Potassium % and ether extract (AOAC.1990) subsequently after each cut. The crop was kept for seed production and at maturity following data was recorded i.e., number of heads (m⁻²) number of seeds head⁻¹, seed yield (kg ha⁻¹) and thousand seed weight (g). After harvesting the crop soil samples were collected for the determination of available Phosphorus & Potassium (U.S. Salinity Lab. Staff, 1954). Following soil analysis data was recorded.

Table: - 1 Detail of treatments applied.

Treatment	Combination	Phosphorus	Potassium
		Kg ha ⁻¹	
T ₁	P ₁ K ₁	0	0
T ₂	P ₁ K ₂	0	30
T ₃	P ₁ K ₃	0	60
T ₄	P ₂ K ₁	30	0
T ₅	P ₂ K ₂	30	30
T ₆	P ₂ K ₃	30	60
T ₇	P ₃ K ₁	50	0
T ₈	P ₃ K ₂	50	30
T ₉	P ₃ K ₃	50	60
T ₁₀	P ₄ K ₁	90	0
T ₁₁	P ₄ K ₂	90	30
T ₁₂	P ₄ K ₃	90	60

Table:-2. Physical & Chemical Properties of Soil.

Property	Soil sampling Depth (0-30 cm)
EC (d Sm-1)	2.1
pH	8.4
CaCO ₃ (%)	8
O.M (%)	0.78
Available P (%)	0.002
Available K (%)	0.001
Sand (%)	38
Silt (%)	36
Clay (%)	26
Textural Class	Loam

RESULTS AND DISCUSSION

It was revealed from the data recorded that in the treatment T₁₂ (P-90 & K-60 Kg/ha) gave maximum plant height 160 cm, number of tillers per plant (10), Number of leaves per plant 36, green fodder yield (111) tons per ha., dry matter yield (6.45) tons per ha., Moisture % (40.53), Ash% (12.65), Crude Fiber % (28.65), Crude Protein % (16.26), Ether Extract % (1.9), Phosphorus % (0.05), Potassium % (0.002), number of heads per sq. meter (2800), number of seeds per head (59.47), thousands seed wt. (2.35) gm and seed yield

(254.45) tons/ha which is more than all the treatments in the experiment.

Plant Height (cm): Plant height (cm) of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum Plant height (cm) obtained in T₁₂ (P=90, K= 60 Kg per ha.) 160 (cm) compared with treatment T₁ control (OP+0K) with lowest plant height 122 (cm) (Table:-3).

Tillers / Plant: Tillers/plant of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum tillers/plant obtained in T₁₂ (P=90, K= 60 Kg per ha.) 10 compared with treatment T₁ control (OP+0K) with lowest tillers per plant 5 (Table:- 3).

Number of Leaves per plant: Number of leaves per plants of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum number of leaves obtained in T₁₂ (P=90, K= 60 Kg per hectare) were 36 compared with treatment T₁ control (OP+0K) with lowest number of leaves per plant 23 (Table:-3).

Green Fodder Yield: Green fodder yield (Tons per ha.) of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum green fodder yield obtained in T₁₂ (P=90, K= 60 Kg per ha.) 111 t/ha compared with treatment T₁ control (OP+0K) with lowest yield 76 t/ha (Table:-3).

Table:- 3 Effect of Phosphorus & Potassium fertilizers on plant height (cm), number of tillers per plant, number of leaves per plant and green fodder yield (tons per hectare).

Treatment	Plant height (cm)	Number of tillers per plant	Number of leaves per plant	Green fodder yield (tons per ha.).
T ₁	122	5	23	76
T ₂	127	3	24	79
T ₃	135	4	25	80
T ₄	135	6	25	80
T ₅	144	7	26	87
T ₆	144	7	32	90
T ₇	152	7	32	93
T ₈	152	9	34	96
T ₉	154	9	35	101
T ₁₀	155	10	35	106
T ₁₁	157	10	35	106
T ₁₂	160	10	36	111

Number of heads per Sq. meter: Number of heads per sq. meter of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum number of heads per sq. meter obtained in T₁₂ (P=90, K= 60 Kg per

ha.) 2800 compared with treatment T₁ control (OP+0K) with lowest number of heads per sq. meter 1732 (Table:-4).

No of Seeds /Head: Number of seed/ heads of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum number of seed /heads obtained in T₁₂ (P=90, K= 60 Kg per ha.) 59.47 compared with treatment T₁ control (OP+0K) with lowest number of seeds per head 37.52 (Table:-4).

Thousand seed weight (gm): Thousand seed weight (gm) of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum thousand seed weight (gm) obtained in T₁₂ (P=90, K= 60 Kgs per ha.) 2.35 (gm) compared with treatment T₁ control (OP+0K) with lowest thousands seed wt. 2.08 gm (Table:-4).

Seed yield (t/ha): Seed yield t/ha of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum seed yield t/ha obtained in T₁₂ (P=90, K= 60 Kg per ha.) 254.45 t/ha compared with treatment T₁ control (OP+0K) with lowest seed yield .240.48 t/ha (Table:-4).

Table:- 4 Effect of Phosphorus & Potassium fertilizers on Number of heads per Sq. meter, Number of Seeds /Head, Thousand seed weight (gm) and Seed yield (t/ha.)

Treatment	Number of heads per Sq. meter	Number of Seeds /Head	Thousand seed weight (gm)	Seed yield (t/ha.)
T ₁	1732	37.52	2.08	240.48
T ₂	1842	38.65	2.12	242.54
T ₃	1875	39.25	2.15	245.52
T ₄	1925	41.25	2.16	247.75
T ₅	2014	42.35	2.17	248.25
T ₆	2025	42.45	2.19	249.15
T ₇	2212	48.24	2.21	251.76
T ₈	2454	48.35	2.21	251.65
T ₉	2542	51.23	2.22	252.42
T ₁₀	2640	51.34	2.25	253.41
T ₁₁	2710	58.24	2.31	253.58
T ₁₂	2800	59.47	2.35	254.45

Dry matter yield (t/ha & %): Seed yield t/ha & % of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum seed yield t/ha & % obtained in T₁₂ (P=90, K= 60 Kg per ha.) 6.45 t/ha & 59.47% compared with treatment T₁ control (OP+0K) with lowest seed yield 0.38 t/ha & 37.52 % (Table:-5).

Moisture %: Moisture % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Moisture % obtained in T₁ control (P=0, K= 0 Kg per ha.) 62.48 % compared with treatment T₁₂ (90P+60K) with lowest moisture % 40.53 (Table:-5).

Ash %: Ash% of Berseem affected by different levels of Phosphorous and Potash fertilizers. Maximum ash% obtained in T₁₂ (P=90, K= 60 Kg per ha.) 12.65 % compared with treatment T₁ control (0P+0K) with lowest Ash % 11.37 % (Table:-5).

Crude Fiber %: Crude Fiber % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Crude Fiber % obtained in T₁₂ (P=90, K= 60 Kg per ha.) 28.65 % compared with treatment T₁ control (0P+0K) with lowest Crude Fiber % 26.24 % (Table: 5).

Crude Protein %: Crude Protein % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Crude Protein % obtained in T₁₂ (P=90, K= 60 Kg per ha.) 16.26 % compared with

treatment T₁ control (0P+0K) with lowest Crude Protein % 11.67 % (Table: 5).

Ether Extract %: Ether Extract % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Ether Extract % obtained in T₁ control (P=0, K= 0 Kg per ha.) 2.4 % compared with treatment T₁₂ (90P+60K) with lowest Ether Extract % 1.9 (Table:5).

Phosphorus %: Phosphorus % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Phosphorus % obtained in T₁₂ (P=90, K= 60 Kg per ha.) 0.05 % compared with treatment T₁ control (0P+0K) with lowest Phosphorus % 0.02 % (Table: 5).

Potassium %: Potassium % in Berseem fodder affected by different levels of Phosphorous and Potash fertilizers. Maximum Potassium % obtained in T₁₂ (P=90, K= 60 Kg per ha.) 0.002 % compared with treatment T₁ control (0P+0K) with lowest Potassium % 0.001 % (Table: 5).

Table:- 5 Effect of Phosphorus & Potassium fertilizers on the quality of Berseem fodder.

Treatment	Green fodder yield	Dry matter yield	Moisture	Ash	Crude Fiber	Crude Protein	Ether Extract	Phosphorus	Potassium
	(t/ha)								
T ₁	37.52	0.38	62.48	11.37	26.24	11.67	2.4	0.02	0.001
T ₂	38.65	0.77	61.35	11.38	26.31	12.04	2.4	0.03	0.002
T ₃	39.25	1.18	60.75	11.39	26.32	12.65	2.3	0.03	0.003
T ₄	41.25	1.65	58.75	11.45	26.98	13.65	2.3	0.04	0.001
T ₅	42.35	2.12	57.65	11.64	27.13	14.01	2.2	0.04	0.002
T ₆	42.45	2.55	57.55	11.65	27.14	14.32	2.1	0.04	0.002
T ₇	48.24	3.38	51.76	11.87	27.34	14.35	2.1	0.05	0.001
T ₈	48.35	3.87	51.65	11.90	27.34	14.58	2.1	0.05	0.002
T ₉	51.23	4.61	48.77	12.32	27.58	15.16	1.9	0.05	0.001
T ₁₀	51.34	5.13	48.66	12.32	27.67	15.21	1.9	0.05	0.001
T ₁₁	58.24	6.41	41.76	12.65	28.31	15.24	1.9	0.05	0.002
T ₁₂	59.47	6.45	40.53	12.65	28.65	16.26	1.9	0.05	0.002

Statistical Analysis: SPSS (Norman *et al*, 2020) soft wear was used for data Analysis.

REFERENCES

AOAC. 1990. Official Methods of analysis, (15th Ed.) Association of official analytical chemists. Washington, D.C, 587p.

Beena Saeed, Hasina Gul, Said Wahab, Yasser Durrani, Bibi Haleema, Muhammad Ayub, Ali Muhammad, Ahmad Said and Ijaz Ahmad. 2011. Effect of phosphorus and potassium on seed production of Berseem Afr. J. Biotechno.

Vol. 10(63), pp. 13769-13772

Dost M. Pakistan forage resource profile, Food and Agriculture Organization Available at www.fao.org/ag/agp/agpc/counprofile. 1997

Geographic of Okara. www.google.com/search/geographic/okara/pakistan. intensive production practices. Nature 2002, 418, 671–677.

Khalid, M., Ijaz, A. and Muhammad, A. Effect of nitrogen and phosphorus on the fodder yield and quality of two Sorghum cultivars (Sorghum bicolor L.). Int. J. Agri. Biol., 5(1):61-63. 2003.

Munir, I., Ranja, A.m., Sarfraz, M., Obaid-ur-Rehman, Mehdiand, S.M. and Mahmood, K. Effect of Residual Phosphorus on Sorghum Fodder in

- Two Textured Soils. *Int.J.Agric.& Biolo.*, 6(6):967-969. 2004.
- Norman H. Nie, C. Hadlai (Tex) Hull and Dale H. Bent . 2020. *Statistical Package for the Social Sciences* University of Stanford
- Pholsen, S. and Suksri, A. Effects of phosphorus and potassium on growth, yield and fodder quality of IS 23585 forage Sorghum cultivar (*Sorghum bicolor* L. Monech). *Pakistan J. Bio. Sci.*,10(10): 1604-1610. 2007.
- Sami Ul-Allah, Asif Ali Khan, Andreas Burkert and Michael Wachendorf, (2014). Socio-Economic aspects of fodder production in urban and peri-urban areas of Faisalabad. *Pak. J. Agri. Sci.*, Vol. 51(2), 493-500.
- Singh B, Virendra S. Agronomic studies on seed production of Berseem in India. *Newslet. Int. Harbage Seed Prod. Res. Group. No.21:14-15.* 1999.
- Tariq Mahmood, Sohail Rashid, Arbab Jahangeer, Muhammad Arshad, Abdul Rahim Khan, Dr. Abdul Majid, Shahbaz Mustafa (2018). Effect of Phosphorous and Potash Fertilizer on Green Fodder and Seed Yield of Berseem (Egyptian clover) under Faisalabad Conditions. *Int.J.Scie.Bas.Appl.Res. Vol. (38), No 2, pp 8-12.*
- U.S. Salinity Laboratory Staff. 1954. *Diagnosis and improvement of saline and alkali soils.*