J. Anim. Prod U.A.R. **3**, No. 2, 95–103 (1963).

EFFECT OF FERTILIZATION PRACTICES UPON THE YIELD, CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF BERSEEM

By

I.M. Elgindi, A. Ghoneim, M.A. Raafat,
E.R.M. Abou Hussein and E.A. Gihad *

SUMMARY

Nine feddans of berseem were subdivided for three fertilization treatments. In the first, 150 kg superphosphate plus 100 kg calcium nitrate were applied per feddan. The calcium nitrate was added in two applications 50 kg after germination and 50 kg before the last cut. The second and the third (control) involved only superphosphate, but at different levels of 150 and 100 kg, respectively. The yield and nutritive value, as determined by digestibility trials of berseem for each treatment was found to be as follows :

1. The yields of berseem with the first and the second treatments were 11.96 and 3.95% respectively, more than the control.

2. No special trends were observed among the different treatments of fertilization with respect to chemical composition, digestion coefficients, digestible nutrients nor nutritive value of berseem.

3. The yields of crude and digested nutrients and the starch value of berseem fertilized with extra amounts of phosphorus and nitrogen (50 kg superphosphate 100 kg Ca $(NO_3)_2$) were always higher than the control. Fertilization with an extra amount of phosphorus only (50 kg superphosphate), failed to promote any increase. The yield of starch value in the first treatment was higher than the control by 9.10% while that of the second treatment was lower than the control by 2.46%.

* Animal Production Department, (Animal Nutrition and Biochemistry) Faculty of Agriculture, Cairo University.

4. The addition of 50 kg of calcium nitrate after germination in the first treatment increased the yield of S.V. by 6.77 %. However applying an additional amount of 50 kg calcium nitrate before the last cut increased the yield of S.V. by only 2.34%. It was concluded that adding an extra amount of nitrogenous fertilizers before the last cut of berseem did not cause any obvious increase of nutrients and starch value.

5. The addition of an extra amount of either superphosphate plus calcium nitrate or superphosphate alone increased P content of berseem by 40.22 and 35.09%, respectively, over the control. Calcium and magnesium contents did not appear to be affected by either treatment.

Introduction and Review of Literature

Plants respond differently to various nutrients in the soil. These nutrients greatly influence the yield of plants and their chemical composition. Berseem, being a legume crop-responds more than gramini to phosphorus during its entire growth period. Singh and Verma, (1953), Sundara Rao and Ghosh, (1954), Tandon and Varchney, (1927) and Hanna, (1959), reported that fertilizing berseem with superphosphate increased its yield.

Berseem also needs small amounts of available nitrogen in the early stages of growth before the fixation of nitrogen in the nodules commences. Roux, (1935), Agiza, (1951), Moon (1954), Walker et al, (1954) and Russell, (1958) found that using nitrogenous fertilizers had a favorable influence on the early growth of leguminous plants and increased the nitrogen fixation. Bartholomew, (1948) used moderate amounts of nitrogen fertilizer with legume crops in the later stages of growth to obtain optimum growth.

Materials and Methods

Nine feddans were cultivated with Miskawi berseem during the year 1960-1961. The area was divided into three sectors. The first sector (P.N.)* was fertilized with 150 kg of

(*) P.N. The sector fertilized by phosphate and nitrate.

superphosphate and 100 kg of calcium nitrate. Calcium nitrate was added after the germination of berseem seeds and before the last cut in equal amounts of 50 kg. The second (P)** and third (control) sectors were fertilized only with 150 and 100 kg of superphosphate, respectively.

Digestibility trials were conducted to determine the nutritive value of the berseem in the different treatments. The animals, weighing, feeding, sampling, recording results and methods of analysis follow the same methods as in the previous paper by Ghoneim et al (1963).

Results and Discussion

1.—*The yield* :

The average yields of berseem per feddan with the three different treatments are shown in Table (1).

TABLE 1.—**Yields of Berseem with Three Different Fertilization Treatments**

The cuts	(P.N.)	(P)	Control
	kg	kg	kg
lst. cut	3060	2900	2825
2nd. cut	5185	4858	4180
3rd. cut	6390	5915	6180
4th. cut	1180	1010	940
Total ..	15815	14683	14125

It can be seen that the total yield of berseem per feddan with the first (P.N.) and the second (P) treatments were higher than that of the control by 1690 kg (11.96%) and 558 kg (3.95%), respectively.

**P. The sector fertillzed by phosphate alone.

TABLE 2.—**Chemical Composition, Digestibility and Nutritive Value of Berseem with Three Different Fertilization Treatments**

The Cuts	Dry Matter	Composition of dry matter					Digestion coefficients					Starch Value
		Crude Protein	Ether Extract	Crude Fibre	N.F.E.	Ash	Dry Matter	Crude Protein	Ether Extract	Crude Fibre	N.F.E.	
						%						
(P.N.)												
1st. cut .	10.48	21.36	3.77	19.16	40.23	15.48	67.33	73.79	57.61	51.07	78.56	5.76
2nd. cut .	13.07	19.20	4.32	22.06	41.13	13.29	62.32	67.27	49.11	47.75	75.11	6.70
3rd. cut .	14.23	17.66	3.46	28.53	36.09	14.26	63.10	72.55	53.38	52.42	77.23	7.01
4th. cut .	21.13	16.77	3.92	31.24	36.82	11.25	59.31	65.99	52.22	48.19	73.05	9.50
(P)												
1st. cut .	10.72	21.26	3.35	19.07	40.10	16.22	65.10	75.32	57.14	45.95	78.44	5.74
2nd. cut .	12.25	19.78	4.22	21.03	42.29	12.68	64.41	70.01	51.94	46.06	78.34	6.61
3rd. cut .	12.94	19.30	3.64	23.85	38.44	14.47	63.17	73.72	56.03	45.20	77.82	6.63
4th. cut .	19.97	16.83	3.57	30.51	37.98	11.11	57.14	64.04	52.34	45.19	73.41	8.85
Control												
1st. cut .	10.54	22.01	3.61	18.88	39.47	16.03	67.44	79.07	62.92	49.41	77.86	5.82
2nd. cut .	12.58	18.92	3.97	20.99	41.33	14.79	70.97	76.73	67.93	51.37	81.88	7.22
3rd. cut .	13.46	18.50	3.94	26.45	37.25	13.86	66.62	76.36	63.99	47.11	79.81	7.09
4th. cut .	21.09	16.31	3.75	31.91	36.08	11.95	61.31	72.17	56.38	45.82	73.66	9.46

Moreover, the data show that fertilizing berseem in the first treatment (P.N.) with 50 kg superphosphate plus 50 kg. Ca $(No_3)_2$) more than the control increased the yield of the three first cuts by 1,450 kg. (10.27%). In the same treatment an extra amount of 50 kg. Ca $(NO_3)_2$) applied before obtaining the fourth cut increased its yield by only 240 kg (1.69%). This result shows that fertilizing berseem with nitrogenous fortilizers in the later stages of growth failed to promote any obvious increase in the yield.

2.—*Chemical composition, digestibility and starch value* :

Table (2) illusrates the chemical composition, digestibility and starch value of berseem with the various treatments during the different cuts. The data show that the type of fertilization of berseem was of only minor importance in relation to its nutritive value.

3.—*The yield of nutrients* :

The yields of starch value and digestible protein of berseem per feddan in the different treatments and cuts are illustrated in Table (3). It can be seen that fertilizing with 150 kg. superphosphate plus 100 kg. Ca $(NO_3)_2$ increased the yield of nutrients. However, fertilizing with 150 kg. of superphosphate failed to promote any increase over the control (100 kg. superphosphate).

TABLE 3.—**Yields of Starch Value and Digestible Protein.**

The Cuts	(P.N.)		(P.)		Control	
	S.V.	Dig. Protein	S.V.	Dig. Protein	S.V.	Dig. Protein
1st. cut	176.3	50.5	166.5	49.9	164.4	51.7
2nd. cut	347.4	87.6	321.1	82.1	301.8	76.5
3rd. cut	447.9	116.3	392.2	110.6	438.2	117.4
4th. cut	112.1	27.6	89.4	21.7	88.9	23.3
Total . .	1083.7	282.0	969.2	264.3	993.3	268.6

The total yield of starch value per feddan in the first treatment (P.N.) was much higher than that of the control by 90.4 kg. (9.10%) while it was lower in the second treatment than that of the control by 24.1 kg. (2.46%).

The data show clearly that fertilization of berseem in first treatment with 50 kg. superphosphate plus 50 kg. $Ca(N_3O)_2$ more than the control, increased the yie'd of starch value by 67.2 kg (6.77%) during the first three cuts. However, applying an additional amount of 50 kg Ca $(NO_3)_2$ caused an increase of only 23.2 kg (2.34%) in the fourth cut. This shows that adding a nitrogenous fertilizer before the last cut of berseem did not cause any obvious increase in its starch value.

4.—*The minerals content* :

Phosphorus, calcium and magnesium contents of berseem in the three treatments of fertilization at the successive cuts are presented in Table (4).

TABLE 4.—**P, Ca and Mg Contents**

The Cuts	(P.N.)			(P.)			Control		
	P	Ca	Mg.	P	Ca	Mg.	P	Ca	Mg.
	(Mg/100 g dry matter)								
1st. cut	375	1872	282	368	1751	156	372	1772	362
2nd. cut	333	1645	406	467	1637	400	329	1635	395
3rd. cut	312	1458	325	357	1328	366	302	1806	413
4th. cut	294	1492	275	353	2008	287	283	1476	186

Phosphorus content of berseem decreased with the successive cuts. It appears that the P contents of berseem in the first and the second treatments were higher than that in the control.

The total yield of phosphorus per feddan was 7.029, 6.772 and 5.013 kg in the first, second and control treatments, respectively. Fertilizing berseem with an extra amount of

either superphosphate plus calcium nitrate or superphosphate alone increased the yield of P per feddan by 40.22 and 35.09%, respectively, over the control.

In this connection El-Kholy, (1955) found an increase in P content of berseem by adding phosphorus fertilizers. Similar results were obtained by Smeath, (1941). These results are in agreement with this work, yet Hanna, (1959) did not get any increase in P with such treatment.

The calcium and magnesium contents of berseem fluctuated without any special trend in the successive cuts nor in the different treatments of fertilization.

REFERENCES

AGIZA, A.H. (1950).—"Nitrogenous constituents in forage crops with particular reference to grass." Ph. D. Thesis, Univ. Edinburgh, Fac. Sci., Dept. Agric.

BARTHOLOMEW, W.V. (1948).—Fertilizers for grass in rotations. Yearbook of Agriculture, pp. 199-202.

EL-KHOLY, B.F. (1955).—"The status of available phosphorus and calcium in clover" M. Sc. Thesis, Fas. Agric., Cairo University.

GHONEIM, A., RAAFAT, M. A., EL GINDI, I.M., ABOU-HUSSEIN, E.R.M. AND GIHAD, E.A. (1963).—Effect on the stage of cutting on the yield, chemical composition and nutritive value of berseem. *J. Anim. Prod. U.A.R.* 3, No. 2, 83-93.

HANNA, F.S. (1939).—"A comparative study between phosphorus uptake by plant and the available phosphorus content in the soils of Egypt."; M. Sc. Thesis, Fac. Agric., Cairo University.

MOON, F.E. (1954).—The composition and nutritive value of hay grown in East Scotland and influence of late application of nitrogenous fertilizers. *J. Agric. Sci.*, 44, 140-51.

ROUX, E. (1935).—Nitrogenous fertilizing of leguminous plants. *Compt., read. acad., Agric., France*, 21, 199-203. (in Chem. Abstr., 1941, 35, 4121).

RUSSELL, E.J. (1958).—Soil Conditions and Plant Growth., 8th Ed., Longmans, Green and Co., London, p. 319-20.

SINGH, G. AND VERMA, P.S. (1953).—Effect of phosphate fertilizing of berseem on its yield and quality. *Agric. Univ. J. Research*, **2**, 45-51.

SMEATH, D.M. (1941).—Fertilizer sincrease the mineral content of forage. Louisiana Fruit & Truck Expt. Sta. Biannual Rept., 1939-40, 40-1. (in Chem. Abstr., 1942, 36, 3895).

SUNDARA ROA, W.V.B. AND GHOSH, A.B. (1954).—Nutrient deficiency sympotms in plants. I. Experiments with berseem (Trifolium alexandrinum). Indian *J. Agr. Sci.*, **24**, Pt IV, 323-31. (in Chem., Abstr., 1955, 49, 9103).

TANDON, R.K. AND VARSHNEY, M.L. (1954).—Effect of mixing of mustard and of phosphate manuring on the yield of berseem (Trifolium alexand rinum). *Agr. Animal Husbandry* **5**, No. 2, 15-16. (in Chem. Abstr., 1957, 51, 9991).

WALKER, T.W., ADAMS, A.F.R AND ORCHISTON, H.D. (1953).—The use of fertilizers on herbage cut for conservation and the effect of rates, methods of application and forms of fertilizer nitrogen on the yields of dry matter and nitrogen of grasses and clovers in a raygrass and with clover sward, cut at different stages of growth. *J. Brit. Grassland Soc.*, **8**, 281-99. (in Nutri- tion Abstr., Rovs., 1954, 24, 524.).

الملخص

تسميد البرسيم بالأسمدة الفوسفاتية والنتراتية وأثره على قيمته الغذائية

لدراسة أثر التسميد على البرسيم اختير اثنا عشر فدانا من المساحة الكلية وقسمت إلى ثلاث معاملات سمدت الأولى منها بمقدار ١٥٠ كجم سوبرفوسفات و ١٠٠ كجم نترات كالسيوم وقد تم التسميد النتراتى على دفعتين متساويتين الأولى بعد الإنبات والثانية قبل الحشة الأخيرة. أما بالنسبة للمعاملتين الأخيرتين فلقد سمدت المعاملة الثانية بمقدار ١٥٠ كجم سوبرفوسفات والثالثة بمقدار ١٠٠ كجم سوبر فوسفات ولقد اختيرت المعاملة الثالثة للمقارنة. كما أجرى حش البرسيم مبكرا أى على ارتفاع ٣٠ – ٣٥ سم. وقد كان محصول البرسيم الأخضر فى المعاملة الأولى والثانية أكبر من المعاملة الثالثة بمقدار ١١,٩٦ ٪ و ٣,٩٥ ٪ على التوالى. ولم تسبب نظم التسميد المختلفة فروقا واضحة فى التحليل الكيماوى ومعاملات الهضم والمركبات المهضومة والقيمة الغذائية للبرسيم وذلك فى حشاته المختلفة. ووجد أن محصول المركبات الخام المهضومة ومعادل النشا للبرسيم فى المعاملة الأولى كان دائماً أعلى من مجموعة المقارنة بينما لم يحقق التسميد فى المعاملة الثانية أى زيادة فى محصول المركبات الخام المهضومة أو معادل النشا عن معاملة المقارنة.

لقد أظهرت نتائج المعاملة الأولى أن التسميد بمقدار ٥٠ كجم نترات كالسيوم بعد الإنبات سبب زيادة فى محصول معادل النشا بمقدار ٦,٧٧ ٪ علاوة على ذلك فان إضافة ٥٠ كجم نترات كالسيوم أخرى قبل الحشة الأخيرة سبب زيادة محصول معادل النشا بمقدار ٢,٣٤ ٪ ويستنتج من ذلك أن إضافة الأسمدة قبل الحشة الأخيرة للبرسيم أى زيادة ملحوظة فى محصول المركبات المختلفة ومعادل النشا.

كما تبين أن التسميد بمقدار ١٥٠ كجم سوبرفوسفات مع أسمدة نتراتية أو بدونها فى المعاملتين الأولى والثانية سبب زيادة فى كمية الفوسفور فى البرسيم بمقدار ٤٠,٢٢ ٪ و ٣٥,٠٩ ٪ عن معاملة المقارنة على التوالى. أما بالنسبة لكمية الكالسيوم والمغنسيوم فلم تظهر أى فروق واضحة.