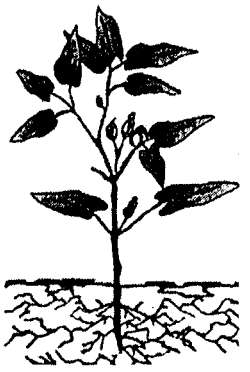


353
Annals
Agric. Sci.,
Ain Shams Univ.,
Cairo, 53(2), 353-362, 2008

EFFECT OF INTERCROPPING WHEAT WITH FODDER BEET UNDER DIFFERENT LEVELS OF N- APPLICATION ON YIELD AND QUALITY

[27]

AbdEl-Gwad, M.S.A.[1]; T.K. Abd El-Aziz[1] and M.A. Abd El-Galil[2]
1- Forage Crops Res. Dept. FCRI, ARC, Giza, Egypt
2- Crop Intensification Res. Dept., FCRI, ARC, Giza, Egypt

Keywords: Fodder beet, Wheat, intercropping, Nitrogen fertilizer, Yield and Chemical composition

ABSTRACT

Two field trials were carried out at Sids Experimental Research Station, ARC, Beni Sueif Governorate through 2004/2005 and 2005/2006 seasons to study the effect of intercropping wheat with fodder beet under different N fertilizer rates on yield, yield components and chemical composition. The intercropping treatment was planting wheat on the back ridges 120 cm wide, in four rows (50 % of solid crop), while the treatments of N fertilizer were 70, 90, 110 and 130 kg N/ fad. The treatments were assigned in randomized complete blocks design with three replications. The results indicated that the application of N significantly increased wheat grains yield/ fad. The increases in grains yield/ fad. were 9.91, 25.44 and 35.24 % for 90, 110 and 130 kg N/ fad., compared with that of adding 70 kg N/ fad. Roots yield/ fad. of fodder beet was significantly increased by increasing N fertilizer level. The increases in roots yield/fad. were 6.80, 25.89 and 28.74 %, compared with that of adding 70 kg N/ fad. Chemical compositions for fodder beet (crude protein, ash, total digestible nutrients and digestible crude protein) of fodder beet were significantly increased by increasing N fertilizer level, while crude fibers take an opposite trend. Intercropping fodder beet with wheat increased land equivalent ratio in the average of both seasons by 1.21, 1.07, 1.15 and 1.22%, when adding 70, 90, 110 and 130 kg N fertilizer/fad., respectively. The total income was calculated by L.E. 4063.81, 5838.00, 6542.50 and 6838.80 for 70, 90, 110 and 130 kg N/ fad., respectively. The highest return between growing fodder beet as sole crop and its growing with wheat was collected when adding 130 kg N/ fad (2718.80 L.E.).

INTRODUCTION

Fodder beet (*Beta vulgaris* L.) is a new established crop in Egypt. It is considered a good source of energy for animal feeding. The roots can be stored in the soil for a period without great damage to be used when needed. Cultivation fodder beet may help in overcoming the problem of animal feeding in the beginning of summer season, but it still has a weak competitive ability against berseem as winter forage. However, increasing and expanding fodder beet acreage can be realized by finding new and additional areas without changing the prevailing winter crop structure through intercropping with some winter crops.

Several reports in the literature emphasized the need for specific intercropping, has become necessary. **Abd El Gawad *et al* (1988)** showed that intercropping wheat with faba bean significantly affected spike length, 100 grains weight and weight of grains/ fad. of wheat. As well as, significantly affected weight of 100-seeds and seeds yield /fad. of faba bean. **Toaima (2006)** reported that intercropping fodder beet with wheat significantly reduced yield and yield components of both

(Received June 30, 2008)
(Accepted September 2, 2008)

crops, but the final yield of both crops was higher than sole crop of each.

Nitrogen is considered one of the major nutrient elements for fodder beet. It affects growth, yield and nutritive value of fodder beet as it is an essential constituent for several physiological and biochemical processes which reflected on the vegetative growth and yield. Increasing N- fertilizer rates increased root diameter and top length as well as root and top fresh weights (**Abd El- Hamid *et al* 1999**).

Said *et al* (1999) indicated that raising nitrogen rates resulted in a significant increase in plant height, root length, root diameter and root fresh yield/ fad. of fodder beet. **Toaima (2006)** stated that increasing N fertilizer level up to 120 kg N/ fad increased yield and yield components of fodder beet and wheat intercrop.

The present work aimed to study the response of wheat to intercropping with fodder beet and effects of N fertilizer rates on yield of both crop, yield components and chemical composition.

MATERIALS AND METHODS

Two field trials were carried out at Sids Experimental Research Station, ARC, in Beni Suief Governorate during 2004/ 2005 and 2005/ 2006 seasons to study the effect of intercropping wheat (cv. Sakha 93) with fodder beet (c.v. Vorochenger) under four levels of nitrogen fertilizer. The treatments were assigned in randomized complete block design with three replicates. The soil was clay in texture with pH of 7.9, 2.3 % organic matter and having 16, 5 and 700 ppm available N, P and K, respectively. Pre seeding crop was maize in both seasons. Experimental plot area was 18 m^2, consisting of 5 ridges, 3.0 m long and 1.20 m wide. Each experiment included the following 4 treatments; one intercropping pattern and four levels of nitrogen fertilizer (70, 90, 110 and 130 kg N/fad.) and the pure stands of each crop.

Fodder beet, as the main crop, was seeded in hills spaced 25 cm on both sides of ridges 120 cm apart both in intercropped and solid patterns to achieve full stand (a plant population of 28.000-plants /fad.).

Wheat as an intercrop, was sown in four lines on the back of the ridge represented 50 % of the solid crop. While, its seeding as a sole crop was seeded in rows 15 cm. width, included 8 rows in 1.20 m width to achieve full stand.

Nitrogen fertilizer was applied as ammonium nitrate (33.5 % N), in three equal doses; the first dose at thinning fodder beet (thirty days after sowing), the second and the third doses were 30 and 60 days after thinning, respectively. Phosphorus as calcium super phosphate (15 % P_2O_5) at rate of 200kg/fad.was added before sowing and Potassium as potassium sulfate (48 % K_2O) at rate of 150 kg/fad.was added in three equal doses; the first dose after thinning fodder beet (45 days) and after sowing wheat, second and third dose was added 30 and 60 days after thinning fodder beet and planting wheat. **Table (1)** presented dates of sowing and harvesting of both crops.

Table 1. Sowing and harvesting dates of fodder beet and wheat

Season	Sowing dates		Harvesting dates	
	Fodder beet	Wheat	Fodder beet	Wheat
2004/2005	Oct. 4th	Nov.12th	May 16th	May 5th
2005/2006	Oct. 9th	Nov.16th	May18th	May 2nd

The studied traits were

Wheat

At harvest, ten guarded of wheat plants were taken randomly from each plot to record the following traits: plant height (cm), spike length (cm), number of grains/ spike and weight of grains / spike (gm).

From each plot, one square meter was harvested and the following traits were calculated: Number of spikes/ m^2, grains yield/ fad. (ardab) and straw yield/ fad. (ton). Ardab of wheat = 150 kg.

Fodder beet

At maturity (220 days after sowing), random sample of ten guarded plants of fodder beet was taken from each plot and the following characters were recorded:

Root weight/ plant (kg), root length (cm), root diameter (cm) and roots yield/ fad. (ton) were calculated from each plot using the data of the two inner ridges.

Random samples (3 roots) were cut in flacks, dried at 70°C till a constant weight. Then they were milled to a fine powder and chemically analyzed to

determine crude protein (CP), crude fiber (CF), ash, ether extract (EE) and nitrogen free extract (NFE) contents. The chemical analysis used in this investigation followed the conventional methods recommended by **A.O.A.C (1980)**. Digestible crude protein (DCP %) and total digestible nutrients (TDN %) were calculated according to the equations of **Church (1979)**,

as: DCP % = CP * 0.929 - 3.48.
as: TDN % = 90.36- 0.29 CP- 0.86 CF.

Competitive relationships and total income

Land Equivalent Ratio (LER) was calculated according to **Willey (1979).**

The total income from each treatment was calculated in Egyptian pound at market price of L.E. 100/ ton of fodder beet, 165/ardab of wheat, 500 for wheat straw (ton) according to **Agricultural Statistical and Economic Sector (2005).**

Statistical analysis

All data were subjected to the proper statistical analysis according to **Snedecor and Cochran (1980)**. Combined analysis over the two seasons of experimentation was done after tested of homogeneity of variance between both seasons. Treatments means were compared by the Duncan's Multiple Range Test 5% level of probability **(Duncan, 1955)**. Only significant means were presented in tables as the follows priority:

1- Interaction between treatment ×years.
2- Treatment means over both seasons.

RESULTS AND DISCUSSION

A: Effect of N levels on

1- Wheat

Data in **Table (2)** showed the effect of intercropping wheat with fodder beet under different N-fertilizer rates on wheat growth, yield and yield components. Growth and yield components were significantly reduced with intercropping, compared with wheat as a sole crop. These results may be due to competition between fodder beet and wheat plants for nutrient, water and solar radiation. Plant height was significantly increased with increasing N- rates up to the highest rate (130 kg N/ fad). Results indicated that raising N rates from 70 kg/ fad to 90 kg N/ fad significantly increased plant height by 6 % under intercropping. Also, increasing N level up to 130 kg/ fad ranked to increase plant height, but the increase did not reach significant level. As compared between plant height solid crop and as intercrop, data revealed that higher plant height was recorded with solid crop than intercrop pattern.

With respect to spike length and weight of grain/ spike, data significantly increased from 70 up to 110 kg N/ fad in intercropped and solid. This means that sowing wheat with fodder beet did not affect this trait.

Number of grains/ spike was increased by adding N fertilizer up to 130 kg N/ fad, but the increase was not significant. On the other hand, solid crop responded to adding N up to 110 kg N/ fad.

Number of spikes/ m^2 responded to adding N fertilizer up to 130 kg N/ fad as intercropping, but as solid crop responded up to 110 kg N/ fad. This trait was affected by competition with fodder beet for nutrient elements.

The previous mentioned results might be due to active effect of nitrogen to incentive cell elongation and divisions resulting in taller internodes, which led to increasing plant height and spike length, as well as, it has encouraging effect on growth affecting increase in metabolic processes in plants and this in turn stimulated their growth which might account for the superiority of grains number/ spike and weight of grains/spike, and increase grain yield / fad. **(Abd El Gawad *et al* 1988).**

With respect of grain yield/ fad. There were significant differences between different levels of N and 130 kg N/fad. gave the highest grain yield/fad. The increase was 9.91, 25.44 and 35.24% for 90,110 and 130 kg N/fad. as compared with 70 kg N/ fad.

There was significant differences between 110 and 130 kg N/fad., this increase amounted to 7.80 %, but from the economic point of view, this increases could not compensate the increase in price of extra N added.

Straw yield/ fad. took an opposite trend and there was no significant differences between N levels under intercropping system.

These data are in accordance with those obtained by **Abd El Gawad *et al* (1988).**

2- Fodder beet

Data in **Table (3)** showed the effect of intercropping wheat with fodder beet under different N levels on yield and yield components of fodder beet. Significant reduction was observed with fodder beet root weight/ plant, root length, root diameter and roots yield/fad, compared to sole crop of

Table 2. Effect of intercropping wheat with fodder beet under different N levels on yield and yield components of wheat

Traits / Treatments	Plant height (cm)		Spike length (cm)	No. of grains/ spike	Weight of grains/spike (g)	No. of spikes/ M^2	Grains yield/ fad. (ardab)	Straw yield/ fad. (ton)
	1st season	2nd season						
70 kg N/fad. intercropping	98.10 g	100.60gf	8.47d	43.65c	1.30c	227.11f	8.37h	2.04d
70 kg N/fad. sole crop	104.50ef	131.37b	10.55c	43.25c	1.32c	405.45c	18.75d	2.08d
90 kg N /fad. intercropping	104.20ef	103.70ef	9.00d	45.03c	1.37c	240.50f	9.20g	2.15d
90 kg N /fad. sole crop	105.50f-d	133.20b	11.30bc	44.50c	1.47b	440.52b	19.30c	2.76bc
110 kg N/fad. intercropping	106.60de	107.70de	10.80bc	45.75bc	1.46b	258.35e	10.50f	2.30d
110 kg N/fad. sole crop	115.50c	149.27a	12.80a	48.75a	1.63a	460.59a	19.70b	3.20ab
130 kg N/fad. intercropping	109.0de	110.30d	11.60b	46.29b	1.47b	275.38d	11.32e	2.40cd
130 kg N/fad. sole crop	116.5c	151.30a	13.55a	49.50a	1.69a	475.66a	20.25a	3.48a

Note: any two means in the same column with the same letters are not significantly different

Table 3. Effect of intercropping wheat with fodder beet under different N levels on yield and yield components of fodder beet

Traits / Treatments	Root weight/ plant (kg)	Root length (cm)		Root diameter (cm)		Roots yield/ fad. (ton)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
70 kg N/fad. intercropping	1.19c	14.80i	15.60h	15.10j	14.93j	30.90k	29.70l
70 kg N/fad. sole crop	2.07a	25.00c	22.00e	22.20c	20.00f	39.50de	38.50f
90 kg N /fad. intercropping	1.27bc	17.07g	17.50g	16.20i	16.05i	33.00i	31.90j
90 kg N /fad. sole crop	2.18a	25.30bc	22.30e	22.60bc	20.30ef	41.00b	39.100d-f
110 kg N/fad. intercropping	1.41bc	20.30f	20.60f	17.40h	17.15h	38.90ef	34.300h
110 kg N/fad. sole crop	2.13a	25.90ab	22.40de	23.00ab	20.90de	41.80a	39.70cd
130 kg N/fad. intercropping	1.53b	22.65de	23.20d	19.00g	18.75g	39.78cd	35.65g
130 kg N/fad. sole crop	2.07a	26.20a	22.80de	23.40a	21.20d	42.100a	40.30c

Note: any two means in the same column with the same letters are not significantly different

fodder beet. Weight of root/ plant responded to adding N rates up to 90 kg / fad, but sole crop did not respond to application of more than 70 kg N/ fad. That means that under intercropping weight of root/ plant needs 20 units of N/fad. to amendment its intercrop with wheat.

Root length responded to N up to 130 kg / fad in both seasons, but solid crop did not respond to more than 70 kg N/ fad in both seasons. The results indicated that competition between wheat roots and fodder beet roots for nutrient elements may have led to reduction in root length.

Root diameter took the opposite trend of root length, that means adding N up to 130 kg N/ fad. gave the highest root diameter, but solid crop responded to adding up to 110 kg N/ fad in both seasons. That mean 20 unit of N were required for root diameter when intercropped with fodder beet, compared to sole crop.

Roots yield/ fad. responded to adding N up to 130 kg N/ fad. The increase was 6.80, 25.89 and 28.74 % in the first season and 7.41, 15.49 and 20.03 % in the second season for 90,110 and 130 kg N/ fad, respectively compared to 70 kg N/ fad.

Applying 110 kg N/fad. led to significantly lower yield than those obtained by adding 130 kg/ fad. and the reduction in yield amounted 2.26 % in the first season and 3.93 % in the second season. But these reduction percentages are not significant taking into consideration the side effects and residuals in the soil and plants as a result of using high doses of N and also, economically the increase in yield could not compensate the increase in price of nitrogen fertilizer.

These results are in agreement with those obtained by **Toaima (2006).**

3- Chemical composition and nutritive value of fodder beet

Data of crude protein (CP), crude fiber (CF), ash, ether extract (EE), nitrogen free extract (NFE), total digestible nutrient (TDN) and digestible crude protein (DCP) percentages of fodder beet as affected by different rates of N fertilization are shown in **Table (4).** The statistical analysis showed significant differences between the different treatments in CP, CF, ash, TDN and DCP. Applying 110 kg N/fad. led to significant increases in this components than those obtained by adding 70 and 90 kg N/fad. except CF, and the increases amounted 4.41 and 2.06 % in CP, 7.84 and 5.02 %in ash, 0.48 and 0.34 % in TDN and 8.23 and 4.73 % in DCP.

No significant difference was recorded between applying 110 and 130 kg N/fad. This means that under intercropping fodder beet dose not need more than 110 kg N /fad.

Competitive relationships and yield advantage of intercrop

Land Equivalent Ratio (L.E.R.)

Results in **Table (5)** showed that intercropping fodder beet with wheat increased land usage in the average of both seasons. Intercropping fodder beet proved advantageous by 1.21, 1.07, 1.15 and 1.22 %, when adding 70, 90, 110 and 130 kg N fertilizer/ fad., respectively.

Total income

Data evaluated the total income of intercropped treatments by L.E. 4063.81, 5838.00, 6542.50 and 6838.80 for the lowest N rate up to the highest rate of N fertilizer, respectively **(Table 5)**.

Net return

Data in **Table (5)** indicated the difference between the total income when growing fodder beet as sole and the advantage return if growing fodder beet and wheat together. The highest difference return was obtained when adding 130 kg N/ fad (2781.80 L.E.), whereas the lowest difference return was calculated with 70 kg N/ fad (163.81).

CONCLUSION

There were significant differences between 110 and 130 kg N/fad. in grain yield of wheat and root yield of fodder beet /fad. as intercrop. The increases amounted to7.8 and 3.93 %, respectively. While, no significant differences occurred between 110 and 130 kg N/fad. in the chemical components of fodder beet as intercrop. The differences return between 110 and 130 kg N/ fad. was 251.3 L.E. Economically this increase could not compensate the increase in the price and the side effects and residuals in the soil and plants as a result of using high dose of nitrogen fertilizer. It could be recommended that intercropping wheat with fodder beet in 4 lines on the back of rows wide 120 cm and adding 110 kg N/fad. gave a preferable yield of both crop.

Table 4. Effect of intercropping wheat with fodder beet under different N levels on chemical composition of fodder beet

Traits / Treatments	CP %	CF %	Ash %	EE %	NFE %	TDN %	DCP %
70 kg N/fad. intercropping	7.93 d	9.79 a	13.38 c	0.97 b	67.92 ab	84.33 c	3.89 d
70 kg N/fad. sole crop	7.94 d	9.55 ab	13.94 abc	0.98 b	67.59 ab	84.43 bc	3.89 d
90 kg N /fad. intercropping	8.07 cd	9.38 abc	13.74 bc	1.21 a	67.62 ab	84.45 bc	4.02 cd
90 kg N /fad. sole crop	8.07 cd	9.13 bcd	13.97 abc	1.10 ab	67.73 ab	84.54 bc	4.01 cd
110 kg N/fad. intercropping	8.28 bc	8.35 e	14.13 ab	1.00 ab	67.75 ab	84.83a	4.21 bc
110 kg N/fad. sole crop	8.45 ab	8.22 e	14.43 ab	1.07 ab	68.28 a	84.74 a	4.37 ab
130 kg N/fad. intercropping	8.42 b	8.95 cd	14.05abc	1.13 ab	66.99 b	84.52 bc	4.34 b
130 kg N/fad. sole crop	8.71 a	8.65 ed	14.50 a	1.10ab	67.49 ab	84.55b	4.61 a

Note: any two means in the same column with the same letters are not significantly different.
CP= crude protein, CF= crude fiber, EE= ether extract, NFE= nitrogen free extract
TDN= total digestible nutrient, DCP= digestible crude protein

Table 5. Yield, LER and income of sole and intercropped wheat with fodder beet

Competitive Relationships	Yield/ fad.			Land Equivalent Ratio			LER	Total income	Net return
Treatments	Fodder beet (ton)	Wheat		Fodder Beet	Wheat				
		Grains (ardab)	Straw (ton)		Grains	Straw			
70 kg N/fad. intercropping	30.30	8.37	2.04	0.78	0.45	0.98	2.21	4063.81	163.81
70 kg N/fad. sole crop	39.00	--	--	---	---	---	---	3900.0	---
90 kg N /fad. Intercropping	32.45	9.20	2.15	0.81	0.48	0.78	2.07	5838.00	1833.0
90 kg N /fad. sole crop	40.05	--	--	---	---	---	---	4005.0	--
110 kg N/fad. intercropping	36.60	10.50	2.30	0.90	0.53	0.72	2.15	6542.50	2467.50
110 kg N/fad. sole crop	40.75	--	--	---	---	---	---	4075.0	---
130 kg N/fad. intercropping	37.71	11.32	2.40	0.97	0.56	0.69	2.22	6838.8	2781.80
130 kg N/fad. sole crop	41.20	--	--	---	---	---	---	4120.0	---

Price: L.E. 165 for ardab wheat – L.E. 500 for ton of wheat straw – L.E. 100 for ton of fodder beet

REFERENCES

Abd El-Gwad, A.A.; A.S. Edris and A.M. Abo-Shetaia (1988). Intercropping faba bean with wheat on growth, yield and yield components of wheat. **Annals. Agric. Sci., Fac. Agric., Ain Shams Univ., Cairo, 33(2): 983-998.**

Abd El-Hamid, M.F.; H.M.M. Abd El-Dayem; A.M. El-Seweedy and A.I.E. El-Shafie (1999). Effect of nitrogen and potassium on some growth characteristics, yield and chemical composition of fodder beet plant (*Beta vulgaris* L.). **Proc. 1st Symp. of the Egyptian Society of Plant Nutrition and Fertilization, September 1997, Cairo. pp. 41-60.**

Agricultural Statistics: Summer and Nile Crops June **(2005). Economic Affair Sec., Vol. (2),** Ministry of Agriculture and Lands Reclamation, Cairo, Egypt.

A.O.A.C. (1980). Official Methods of Analysis of the Association of Official Analytical Chemists **12th Ed.** Washington, D.C.

Church, D.C. (1979). Livestock Feeds and Feeding 4th Ed. p. 79. O&B Books Inc:Corvallis, Dragon 97330, U.S.A.

Duncan, D.B. (1955). Multiple ranges and multiple F- test. **Biometrics 11: 1-24**

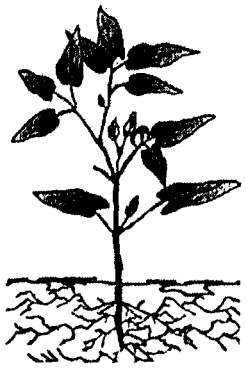
Said, E.L.M.; E.M. Gabr and A.A. Sarhan (1999). Response of some wheat varieties to planting dates and nitrogen fertilization. **J. Agric Sci., Mansoura Univ., Egypt, 24(6): 2711-2720.**

Snedicor, G.W. and W.G. Cochran (1980). Statistical Methods. 7th Ed. Oxford & J. BH Publishing Com.

Toaima, S.E.A. (2006). Response of onion, faba bean and wheat to intercropping with fodder beet under different fertilizer levels of N.P.K. **Minufiya J. Agric. Res. Egypt, 31(4): 939- 956.**

Willey, R.W. (1979). Intercropping: its importance and research needs. Part 1. Competition and yield advantage. **Field Crops Abst. 32: 1-10.**

٣٦١
حوليـات العلـوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٣)، عدد (٢)، ٣٥٣-٣٦٢، ٢٠٠٨



تأثير تحميل القمح مع بنجر العلف تحت مستويات مختلفة من التسميد النيتروجينى على الحاصل وجودته

[٢٧]

مصطفى عبد الجواد سيد عبد الجواد[١]- طارق كامل عبد العزيز[١]- عبد الجليل محمد عبد الجليل[٢]

١- قسم بحوث محاصيل العلف- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية- الجيزة- مصر

٢- قسم بحوث التكثيف المحصولي- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية- الجيزة- مصر

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بسدس محافظة بنى سويف خلال موسمي ٢٠٠٤/٢٠٠٥ و ٢٠٠٥/ ٢٠٠٦ لدراسة مدى استجابة القمح (صنف سخا ٩٣) للتحميل مع بنجر العلف (صنف فوروشينجر) تحت أربع مستويات من التسميد النيتروجيني (٧٠ و ٩٠ و ١١٠ و ١٣٠كجم نيتروجين/ الفدان). وزرع القمح على مصاطب بعرض ١٢٠ سم على ظهر المصطبة فى أربع صفوف (٥٠ % من المحصول المنفرد). واستخدم تصميم القطاعات الكاملة العشوائية في ثلاث مكررات.

وكانت النتائج المتحصل عليها كالتالي

- زاد انتاج الفدان من القمح بنسبة ٩,٩٢ و ٢٥,٤٥ و ٣٥,٢٤ % عند أستخدام مستويات التسميد ٩٠ و ١١٠ و ١٣٠ كجم / نيتروجين للفدان مقارنة بمستوى التسميد ٧٠ كجم للفدان كمحصول محمل.
- زاد المحصول المحمل من بنجر العلف بنسبة ٧,٤١ و ١٥,٤٩و ٢٠,٠٤ % عند استخدام مستويات التسميد ٩٠ و ١١٠و ١٣٠كجم نيتروجين للفدان مقارنة بمستوى التسميد ٧٠ كجم للفدان.
- أدى التسميد بالمستوى العالي من النيتروجين (١٣٠ كجم نيتروجين/ الفدان) إلى الحصول على أعلى القيم من المكونات الكيميائية لبنجر العلف (البروتين الخام , الرماد, المواد المهضومة الكلية و البروتين الخام المهضوم) بينما التسميد بالمستوى المنخفض (٧٠ كجم/ فدان) اعطى اعلى قيم من الألياف الخام.
- سجل معدل استغلال الأرض (LER) زيادة تقدر بحوالي ١,٢١ و ١,٠٧ و ١,١٥ و ١,٢٢عند التسميد بالمستويات ٧٠ و ٩٠و ١١٠ و١٣٠ كجم نيتروجين/ للفدان على الترتيب.. بينما سجل المعدل المنخفض من النيتروجين ٧٠ كجم للفدان أقل النتائج.
- سجل تحميل القمح مع بنجر العلف بأستخدام أعلى مستوى من التسميد إلى زيادة في العائد النقدي بما يعادل ٢١٥٧,٩٠ و ٢١٤٥,٦٠جنيه مصري مقارنة بزراعة بنجر العلف منفردا لكلا الموسمين على

تحكيم: أ.د توكل يونس رزق
أ.د عبد العليم متولى عبد الرحمن

التوالى. سجل معدل الدخل الكلى بما يعادل ٤٠٦٣,٨١ و٥٨٣٨,٠٠ و٦٥٤٢,٥٠ و٦٨٣٨,٠ جنيه مصري عند التسميد بالمستويات ٧٠ و ٩٠ و١١٠ و١٣٠ كجم نيتروجين/ للفدان على الترتيب.

- سجل معدل الفرق بين زراعة بنجر العلف كمحصول فردى مقارنة بزراعتة كمحصول محمل مع القمح بما يعادل ٢٧١٨,٨ جنيه عند استخدام المعدل العالى من النيتروجين ١٣٠ كجم/ للفدان بينما سجل المعدل المنخفض من النيتروجين (٧٠ كجم / للفدان) ١٦٣,٨١ جنيه .