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PRODUCTIVE PERFORMANCE OF BUFFALO CALVES AS AFFECTED BY USING SOME OF CONSERVED GREEN FORAGE:
2- GROWTH PERFORMANCE AND METABOLIC ACTIVITY.

Zeidan, Soheir M. *; M. E. Lashien and H. S. Ali***

* **Animal Production Research Institute, Agricultural Research Center, Dokki, Giza**

** **Department of Animal Production, Faculty of Agriculture, Al- Azhar University, Cairo, Egypt.**

ABSTRACT

This work was carried out at Mehalet Mosa Experimental Station, Animal Production Research Institute. Twenty-eight buffalo male calves were used to study the effect of using three different forages, maize stover silage (TMSS group), whole plant maize silage (WMS group), berseem silage (TBS group) versus traditional ration contain berseem hay (CBH as control group) beside concentrate and rice straw on growth performance, feed utilization and economical efficiency. The calves were fed according to Shehata allowances (1970) by 70% concentrate and 30 % forage as 2 kg/h/d rice straw with ad lib silage or hay. The main results showed that berseem silage and berseem hay rations were higher in CP % than the other rations. There was superiority for (WMS) silage in DM, EE, NFE and OM content than TMSS silage. Also, DMI for WMS group of calves was slightly more than the other tested groups. The difference among groups was not significant. Calves of TMSS group consumed slightly less amount of SE intake compared with the other feeding groups. The WMS group had the highest feed conversion being 10.50, 6.15 and 0.93 kg/kg gain for DMI, DCPI and SEI, respectively, compared with that of the control group (11.95, 6.22, 1.09 kg/kg gain, respectively). The highest values of weight gain per DCP consumed were recorded for TMSS and WMS groups. On the other hand, WMS group had attained the highest average daily gain. The relative growth rate of WMS and TBS groups was higher by 9.19 and 3.06%, respectively than control group (CBH), while TMSS group was decreased by 10.72% than the control one. Non significant difference was observed in average relative growth rates among the different groups in the feeding trial. Feed cost of weight gain was decreased by 21.59%, 19.37% and 20.66% for TMSS, WMS and TBS groups than control group. Also, economical efficiency for the same groups improved by 27.8%, 23.95% and 26.02%, respectively, compared with CBH group. There were no significant differences in all blood parameters among all tested groups.

Keywords: Maize stover silage, maize silage, berseem silage, buffalo calves, growth.

INTRODUCTION

In Egypt, among the most important factors limiting the animals' production is the gap between the requirement of ruminant and the available amount of feeds around the year. One of the main causes of this gap in animal feedstuff is related to the great competition between the human and animal on the limited cultivated land for the food production. This situation resulted in serious problem especially in summer season due to acute shortage of green forage needed to cover the animal requirements. There are two million feddans cultivated annually with maize crop, which produce more

than 4.31 million tons dried corn stover (Agricultural Economics, 1999). Few quantities of this residue are used for feeding animals as fresh form, while the major quantities are used mainly as fuel or left in the field causing pollution problem. The great amount of the by product (corn stover) remaining in filed may offers a large potential source of energy for ruminant animals (Colenbrander *et al.*, 1971) and increase the total nutritive value of the crop by one to third (Ensminger et *al.*, 1990). Ensiling the vegetative material reduces field losses and may be more palatable than if it is utilized by grazing. Ensiling of corn stover is considered as proper solution to decline the shortage in summer green forage. Therefore, the main objective of the present work is to study the effect of using different types of forages, as whole plant maize silage, maize stover silage, berseem silage and berseem hay (as control group), on performance of buffalo male calves.

MATERIALS AND METHODS

Twenty-eight buffalo male calves with average live body weight (LBW) 197.25± 4.51 kg and at about 371.52±2.44 days of age were used in this study. Calves were divided into four similar groups (seven in each) according to live body weight and age. All animals were fed according to Shehata allowances, (1970) and the requirements were adjusted every two weeks according to body weight changes. The calves were offered salt lick block and kept under routine veterinary supervision during the experimental period (240 days). The animals were individually fed twice daily on concentrate feed mixture at 8.0 a.m. and 4.0 p.m., rice straw at 9 am. and silage or hay once daily at 11 a.m. Each calf was weighed in the morning before drinking and feeding biweekly (fasting body weight). Calves were fed on rations containing 70: 30 concentrate mixture: roughage. Roughage consisted of about 2-kg/h/d-rice straw and ad lib silage or hay. The groups were classified according to their feeding on silage or hay as treated maize stover silage with 0.5% urea +2.5% molasses (TMSS group) whole plant maize stover silage (WMS group), berseem silage 1st cut treated with 50 kg ground maize/ton (TBS group), berseem hay (CBH group) as control group. Blood samples were collected after 4 weeks of the beginning of the feeding trial then monthly from all calves at 8.0 a.m. before feeding via jugular vein. Blood samples were used to determine blood urea nitrogen (BUN), total Protein (TP), albumin (AL), creatinine and GPT and GOT activities according to (Henery, *et al.*, 1974; Douams, *et al.*, 1971; Faweat and Seott, 1960; Larsen, 1972; Reitman and Frankel, 1957). The chemical analysis of total ingredients was determined according to the method of A.O.A.C. (1980). The economic efficiency of used rations was calculated by dividing the cost of outputs (live weight gain) by the cost of inputs (feed consumed), based on the current prices. Prices of maize stover silage, maize silage, berseem silage, berseem hay, concentrate and rice straw were 27.5, 83, 45, 385, 530 and 56 LE per ton, respectively whereas price of selling one kg live body weight was (8 LE).

Data were statistically analyzed using the general linear model program of SAS (1988). The differences among means were tested using Duncans Multiple Range Test (Duncan, 1955).

Table (1): Chemical analysis % (on DM basis) of tested ingredients and calculated composition of the experimental rations.

Ingredient	DM	CP	EE	CF	NFE	ASH	OM
MSS. Silage	32.57	5.79	1.43	31.3	48.1	13.38	86.62
MS. Silage	33.68	7.84	3.20	21.03	59.33	8.60	91.40
Bersem* silage	28.95	14.23	3.82	25.65	43.49	12.81	87.19
Berseem* hay	91.22	12.57	2.55	24.52	46.67	13.69	86.31
Concentrate	90.35	16.96	4.61	18.20	53.46	6.77	93.23
Rice straw	88.78	2.80	1.85	39.50	37.24	18.61	81.39
Calculated composition of mixed rations (as % of DM basis):							
MSS+con+ric.	77.57	14.02	3.41	22.79	50.97	8.81	91.19
MS+ con + rice	77.80	13.80	4.30	18.82	54.74	8.34	91.66
BS+conc + rice	76.82	15.20	4.20	21.56	49.97	9.07	90.93
BH+conc+ rice	89.88	14.85	3.93	21.31	50.65	9.26	90.74

*** Berseem 1st cut.**

RESULTS AND DISCUSSION

1-Chemical composition of tested rations:

The chemical composition of the different experimental rations is presented in Table (1). Composition of the fresh tested silages cleared that DM contents of MSS and MS silages (32.57% and 33.68%) were in the range obtained by Bendary *et al.*, (2001a) being 28.19 to 35.08%, they reported that this range might be the major factor to limit the anaerobic fermentation of materials during ensiling for making good quality silage. Berseem silage BS had the lowest value of DM content (28.95%) and highest CP (14.23) in comparison with the other silages. However, maize silage ration had higher content of OM% and NFE % and lower content of CP% and ASH % than the other rations. This finding was in agreement with Ghanem, (1986) and Abd El-Baki *et al.* (1994). This data indicated considerable superiority for whole maize silage in DM, CP, EE, NFE and OM content than maize stover silage. This result was in harmony with that obtained by Mostafa *et al.* (2000) and El-Saadany *et al.* (2001).

2-Growth performance:

Data in Table (2) show that final body weights for the groups fed on rations containing maize silage or berseem silage (WMS or TBS groups) were slightly higher than those groups fed on maize stover silage or berseem hay rations (TMSS and CBH). Also, the same groups, WMS and TBS had the highest total weight gain (234.85 and 221.71 kg, respectively) at the end of whole experimental period (240 day) compared by the other groups. Also, the same groups, WMS and TBS attained higher daily weight gain (DWG) than TMSS and CBH groups (0.978 and 0.923 vs. 0.801 and 0.866 kg/h/d). This finding may indicate less palatability and less CP% for maize stover silage

compared by both whole maize silage and berseem silage. Differences in average total weight gains and daily weight gains among groups were significant (P<0.05) except non-significant differences with WMS group. The average relative growth rate (RGR) among the feeding period was higher for WMS than TMSS, TBS and CBH groups (Figure 1). Groups of WMS and TBS increased their RGR by 9.19 and 3.06%, respectively than the control group (CBH), while, TMSS group decreased RGR by 10.72% than the control group. Differences in RGR among the different types of rations used in the feeding trial were not significant.

Table (2): Growth performance of buffalo calves groups fed on experimental rations.

Items	Experimental groups			
	TMSS	WMS	TBS	CBH
Av. Initial LBW (kg)	197.10± 6.68	197.29±7.95	197.29±7.13	197.29±14.41
Av. Final LBW (kg	389.71±15.88	432.14±13.01	419.00±16.07	405.14±14.05
Av. TWG (kg)	192.57±32.57^{b}	234.85±19.98^{a}	221.71±36.16^{ab}	207.85±20.52^{ab}
Av. DWG (kg/h/d)	0.801±0.013^{b}	0.978±0.08^{a}	0.923±0.50^{ab}	0.866±0.09^{ab}

a, b,c Means with different superscripts in each column differ significantly (p< 0.05)

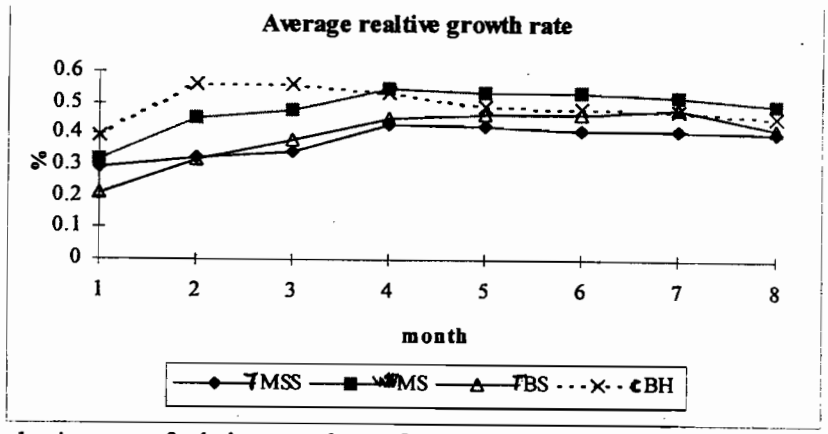

Figure 1: Average of relative growth rate for buffalo calves fed on experimental rations during the whole trial period (240 days).

3-feed intake and efficiency of utilization:

The results in Table (3) revealed that average DMI ranged from 9.54 to 10.25 kg/h/day for the four experimental groups. The differences between groups were not significant. These estimates were lower than those observed by El-Saadany *et al.,* 2001, (11.31 to 12.60kg/h/d). The slightly higher DM intake expressed as kg/h/d was by WMS, TBS and CBS groups was considerably reflected on the increased DWG of the same groups. This result was agreement with those found by (Afifi *et al.,* 1974 and Soliman, 1987).

Mean values of SEI and DCPI were relatively similar among groups WMS and TBS being 5.95 and 5.83 for SEI as well as 0.9 and 1.05 for DCPI,

respectively. Moreover, SEI and DCPI of those groups were significantly (P<0.01) higher than that of TMSS group. Also, DCPI consumed by TBS group was higher by 12.9% than CBH group and by 34.62% than TMSS group. There was no significant effect for DMI due to sequences of feeding. During the feeding trial, calves of TMSS group consumed the lowest amounts of DM, SE, and DC.

The efficiency of feed utilization expressed as the amount of LBW gain per one kg DMI, SEI and DCPI consumed are presented in Table (3). Groups of WMS and TBS had higher efficiency to utilize DMI, than the other groups, while, the best utilization efficiency of SEI and DCPI were found with buffalo groups of TMSS and WMS compared to group TBS. On the other side, calves fed on beseem hay (CBH group) had low efficiency. The higher or lower feed efficiency is usually dependent on the feed unit intake as well as daily weight gain, this result was in agreement with that obtained by Etman *et al.*, (2001). The difference between groups was significant (P<0.05) with DCP consumption only. The results revealed that the highest value of weight gain per kg DCP consumed was recorded for calves fed maize stover silage and maize silage. This may be attributed to the low DCP intake and protein content of their rations which was sufficient for both maintenance and production requirements for satisfactory body weight gain. Similar trend was observed with feed conversion express as DMI, SEI and DCPI to produce one-kg gain.

Table (3): Average feed intake and efficiency of feed utilization by buffalo male calves fed on experimental rations throughout feeding trial (240 days).

Items	Experimental groups			
	TMSS	WMS	TBS	CBH
Average daily feed intqake:				
DMI kg/head/day	9.54± 0.38	10.22±0.24	10.19±0.22	10.25±0.48
*S.EI kg/head/day	4.84± 0.19 ^{c}	5.95± 0.14^{a}	5.83± 0.13^{ab}	5.34±0.25^{bc}
*DCPI kg/head/day	0.78± 0.03 ^{c}	0.90± 0.02 ^{b}	1.05± 0.02^{a}	0.93± 0.04^{b}
Av. Daily gain kg/day	0.801± 0.013^{b}	0.978± 0.08^{a}	0.923± 0.05^{ab}	0.866± 0.09^{ab}
Feed efficiency:				
Kg gain / Kg DMI	0.084± 0.004	0.096± 0.004	0.091± 0.005	0.084±0.006
Kg gain /Kg S.E.I	0.164± 0.008	0.165± 0.005	0.159± 0.011	0.162 ± 0.011
Kg gain/Kg DCPI	1.023± 0.05^{ab}	1.088± 0.04^{a}	0.881± 0.06^{b}	0.928± 0.06^{ab}
Feed conversion:				
Kg DMI / kg gain	12.06± 0.60	10.50± 0.39	11.29± 0.73	11.95± 0.77
*Kg S.EI / kg gain	6.13 ±0.30	6.15 ± 0.23	6.46± 0.42	6.22 ± 0.40
*Kg DCPI / kg gain	0.99 ± 0.05^{ab}	0.93 ± 0.04^{b}	1.16 ±0.08^{a}	1.09 ± 0.07^{ab}

***Calculated according to Lashien *et al.*, (2003) (under publication).**
a,b,c Means with different superscripts in each column differ significantly (p< 0.05)

4-Economic efficiency:

The economic efficiency was calculated as the ratio between price of weight gain and cost of feed consumed. In this study, the feed cost of weight

gain was decreased by 21.59%, 19.37% and 20.66% for TMSS, WMS and TBS groups respectively compared with control group (CBH). The highly reduction of feed cost for TMSS group than the others may be attributed to the low feed intake of high price concentrate feed mixture. Also, the economic efficiency for the previous three groups were reduced by 27.8%, 23.95% and 26.02%, respectively compared with control group. Buffalo calves groups of WMS and TBS attained better performance during the feeding period (240 days) than the other groups while its economic efficiency were equal to the othe groups. El-Saadany *et al.,* (2001) observed a decreased feed cost by 7.10 and 7.58% for maize stover silage and maize silage rations respectively than control group. Also, obvious decrease in the cost of feed in ration containing whole maize plant silage was observed by Bendary and Younis (1997) and Ghanem *et al.,* (2000).

Table (4): The intake from fresh rations and economic efficiency of production for the experimental buffalo calves groups.

	Experimental groups			
Items	**TMSS**	**TMS**	**TBS**	**CBH**
Av. Daily feed intake as fed (kg)				
Silage	7.060	6.800	8.430	----
Concentrate mix.	5.840	6.800	6.560	6.500
Rice straw.	2.200	1.990	2.060	1.800
Berseem hay.	-----	-----	-----	3.050
Cost of feed consumed (L.E)*	3.400	4.278	3.973	4.694
Price of the wt. Gain (L.E)	6.416	7.832	7.392	6.928
Feed cost / kg weight gain.	4.250	4.370	4.300	5.420
Economical efficiency**	1.887	1.830	1.860	1.476

*** Feed cost / head /day (L.E) = feed intake X cost of kg diet.**

**** Economic efficiency = Price of the wt. Gain (L.E) / Cost of feed consumed (L.E)**

5-Blood metabolites:

Data in table (4), indicated that average concentrations of serum total protein (TP) and albumin (AL) as well as globulin (GL) were slightly higher for calves fed on MS, BS and BH rations than calves fed on maize stover silage. The values of TP, AL and GL for all studied groups were at the normal range of buffalo species, these results are in agreement with that obtained by Doumas *et al.,* (1971). The levels of serum globulin and A/G ratio for all animals were fluctuated during the growth period with non-significant differences. These results show that adding 0.5% urea plus 2.5% molasses in chopping maize stover silage had no effect on serum TP,AL,GL,A/Gratio, and serum creatinine which indicated that biosynthesis of those metabolites in liver was normal and that kidney function did not influenced by the treated silage. Differences in blood content of those metabolites among the experimental groups were not significant. There was a slight increase in the serum content of GPT and GOT for animals fed on berseem silage compared with the other rations, which indicate that there was no harmful effect on liver tissue, as found by El-Saadany *et al.,* (2001).

Table (5): Effect of feeding of experimental rations on blood metabolites of buffalo male calves.

Items	Experimental groups			
	TMSS	WMS	TBS	CBH
TP g/100ml	7.21± 0.21	8.17± 0.39	7.91± 0.95	8.08± 0.52
AL g/100ml	3.98±0.50	4.16 ± 0.22	4.04±0.38	4.37± 0.32
GL g/100ml	3.23± 0.33	4.01±0.53	3.87± 0.68	3.78 ±5.67
A/G ratio	1.232± 0.28	1.037±0.25	1.044±0.71	1.156± 0.05
Urea mg/100 ml	10.74±0.94	9.98 ±1.50	10.70 ±1.57	13.34±1.15
Creatinine mg/L	12.12±0.06	2.86 ± 0.66	1.93 ±0.08	2.15 ±0.27
GPT Units/L	16.94±1.54	15.50± 0.62	17.71±1.10	17.9± 1.18
GOT Units/L	39.87±2.40	45.31±3.62	43.48±2.79	39.09±2.64

a , b, c Means with different superscripts in each column differ significantly (p< 0.05)

CONCLUSION

Results of the present study revealed that growth performance and economic efficiency of production were improved by feeding buffalo calves on either silages of whole maize, maize stover or the 1st cut welted berseem. In other words, enclosure of any of those silages in buffalo ration would be helpful to fulfil the calf feed requirements during summer and to enhance the fattening process.

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الأداء الإنتاجي لعجول الجاموس المغذاة علـــى أنـــواع مختلفـــة مـــن الأعـــلاف الخضراء المحفوظة

٢-النمو و معدل التمثيل الغذائي .

سهير محمود زيدان [١] ، محمد السعيد لاشين [٢] ، هشام سيد على [١]

١-معهد بحوث الأنتاج الحيوانى _مركز البحوث الزراعية _وزارة الزراعة _القاهرة -الدقى.

٢- قسم الانتاج الحيوانى_كلية الزراعه _جامعة الازهر.

استخدم في هذه الدراسة ٢٨ عجل جاموس لدراسة تأثير استخدام ثلاثة أنواع من الأعلاف الخضراء المحفوظه مثل سيلاج عيدان الذرة ، وسيلاج نبات الذرة الكامل ، وسيلاج البرسيم مقارنة مع عليقه تقليديـــة تحتوي علي دريس البرسيم وذلك بالاضافه إلي العلف المركز وقش الأرز وذلك على كل من معدل النمـــو والنشاط التمثيلي واستهلاك الغذاء وكذلك الكفاءة الغذائية الاقتصادية . غذيت العجول طبقا لمقررات شـــحاته ١٩٧٠ على علائق مكونة من ٧٠ % علف مركز، ٣٠% علف خشن يتكون من سيلاج أو دريس بجـــانب (٢ كيلو جرام قش أرز يوميا). احتوت كلا من علائق سيلاج البرسيم ودريس البرسيم على نسب عاليـــة من البروتين الخام أعلى من باقى العلائق. كما تفوق سيلاج الذرة الكامل في محتواه من كل من المادة الجافـة والبروتين الخام مستخلص الأثير والمستخلص خالي الآزوت وكذلك المادة العضوية على سيلاج عيدان الـذرة. وكانت كمية المأكول من المادة الجافة متماثل تقريبا مع كل المعاملات وذلك بفروق غير معنوية.

وكان المستهلك من سيلاج نبات الذرة الكامل كمعادل نشا اقل عن باقي المجاميع .وكانت أعلـــى فـــي الكفاءة التحولية بالنسبة لسيلاج نبات الذرة الكامل ٦,١٥- ١٠,٥ - ٠,٩٣-كجم /١ كجم نمو وكذلك للمـــادة الجافة والبروتين المهضوم ومعادل النشا علي التوالي بالمقارنه بمجموعة الكنترول .

وكانت اعلي قيمه في معدل النمو لكل وحدة بروتين خام مهضوم مستهلك لمجموعة العجـــول المغـــذاة على سيلاج عيدان الذرة وسيلاج النبات الكامل ؛ بينما مجموعة سيلاج نبات الذرة الكامل حصلت على أعلـــى معدل نمو يومي . هذا وقد تحسن معدل النمو النسبي للمجاميع المغذاة علي سيلاج نبات الذرة الكامل وسيلاج البرسيم ١٩, ٩% ٠ ٣,٦ % على التوالي بالمقارنه بمجموعة الكنترول بينما انخفضت مجموعـــة ســـيلاج عيدان الذرة بنسبة ١٠,٧٢ %. هذا ولم توجد أي فروق معنوية في معدل النمو النســـبي بيـــن المجـــاميع المختلفة المستخدمه في التجربة . كذلك انخفضت تكاليف التغذية بالنسبة لمعدل النمو بنســـبة ٢١,٥٩% , ١٩,٣٧ %, ٢٠,٦٦% , لكل من مجاميع سيلاج عيدان الذرة وسيلاج نبات الذرة الكامل وسيلاج البرســـيم أكبر بالمقارنة بمجموعة التغذية التقليدية .هذا وقد تحسنت الكفـــاءة الاقتصاديـــة لنفـــس المجـــاميع بنســـبة ٢٧,٨ % , ٢٣,٩٥ %, ٢٦,٢% عن مجموعة دريس البرسيم (المقارنة).

كما كان تأثير جميع العلائق المختبرة غير معنوي على كلا من مقاييس الدم المستخدمة فـــي هـــذه الدراسة.