Impact of substitution of Maize silage with silage of onion veins and lemon pulp mixture on the productive performance of small ruminants

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ABSTRACT

Thirty Barki lambs aged 5 months (22.90 ± 0.15 kg) were divided to three experimental groups (10 per group). First group (R1) fed CFM plus maize silage (60:40%), as control. Second group (R2) fed 60% CFM + 20%maize silage + 20% onion veins and lemon pulp silage (50% to replace of all MS). Third group (R3) fed 60% CFM + 40% onion veins and lemon pulp silage (100% to replace all of MS). The experimental period was extended to 5 months. Lambs were fed the rations with two levels from silage of onion veins and lemon pulp mixture and the roughage concentrate ratio was 60:40%, respectively.

Results showed that values of pH were in normal range but there were increase in NH_3-N content, while there was decrease in Acetic acid content. R1 was related to be the superiority over the other ration for their GP, CH_4, DOM, and MCP and in- situ degradability. All nutrients digestibility and all rumen parameters were decrease by increased level of OLS replacement. There was decreasing in Malondialdehyde while there was increasing in CAT, SOD and GSH for R2 and R3 compared to R1. ADG was decrease while FCR was increase by increasing level of replacement. It is possible to substitution onion and lemon pulp silage instead of MS silage by 50% to reduce feeding cost and to obtain a relatively reasonable return but reducing the replacement rates to less 50% may be more profitable and without adverse effect on animal production.

Key words: *Maize silage, onion veins, lemon pulp, antioxidant, rumen fermentation.*

INTRODUCTION

With the increasing problem of covering nutritional requirements of animals around the world, including Egypt, due to the unprecedented rise of feed ingredients inputs price, the activity of researchers to find appropriate solution to solve this problem has increased. With increasing in breeder's reliance on silage to feed their animals, especially maize silage in their feeding programs. This has increased the demand on maize silage to be one of the main components in animal nutrition, which affects the important use of corn in the production of maize oil necessary for human consumption and also, its demand for poultry feeding programs. Which led researchers try to find alternatives to reduce the use of corn in animal feed. Theses alternative includes other sources of by-products of some crops and by-products of agricultural industrialization to replace part of the corn in the form of silage. Theses by-products include onion wastes and lemon pulp (**Maghsoud *et al.*, 2022**).

Using feed additives is being commonly in animal production like minerals, amino acids and phytobiotics. Plant feed additives had received attention in livestock production in the world (**Sretenovic *et al.*, 2007**). It is well known that medical plant like Citrus family being antioxidant source (phenolic

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compounds, flavonoids and pectin) and bioactive compounds **Askar *et al.*, (1998)**. Essential oils of herbals containing a lot of compounds that may had medicinal effect.

Herbal Plants such as Allium and lilies species (onions and garlic) which contain high levels of allicin, thiosulfinate functional group which had antimicrobial effects for a lot of microbes, such as ruminal bacteria (archaea and pathogenic bacteria) **Kamel *et al.*, 2008.**

Onion (Allium cepa L.) had used as a food and medicinal herb; it was grown worldwide in 170 countries (FAO, 2018). It has peculiar taste and a lot of health benefits. Processing of onion resulted large amount by-products (cover) which consider the main of part of waste (up to 60%), **Gawlik-Dziki *et al.*, (2015).** This by- products used as fertilizer

The onion skin and pulp contain a lot of bioactive compounds likes organosulfur compounds (OSCs), polyphenols and flavonoids (**Putnik *et al.*, 2019; Sagar *et al.*, 2018, 2021**) the most effective bioactive compounds is the flavonoids (very active antioxidants) that used for treat a lot of ailments such as diabetes, cancer **Marrelli *et al.*,2019**). By-products of onion can be used in functional food also, being natural antioxidant

The main purpose of this experiment was to investigate the possibility substitution of maize silage with silage of onion veins and lemon pulp mixture with 50 and 100% on nutrients digestibility performance, gas production, antioxidant activities and economic efficiency of lambs.

MATERIALS AND METHODS

This experiment was carried out at Nubaria experimental station, Animal Production Research Institute (APRI), during year of 2023

Animals' management and rations:

Thirty Barki lambs aged 5 months with average body weight was 22.90 ± 0.15 kg randomly divided into three groups (10 lambs per group). First group (R1) fed CFM plus maize silage (60:40%), as control. Second group (R2) fed 60% CFM + 20%maize silage + 20% silage of onion veins and lemon pulp (50% to replace all of MS). Third group (R3) fed 60% CFM + 40% onion veins and lemon pulp silage (100% to replace all of MS) and the lambs were fed ration by 3% from their body weight. Lambs were housed in open house system during the experimental period for 5 months. The concentrate feed mixture (CFM), maize silage and/or silage of onion veins and lemon pulps were offered together for lambs 2 times per day at 8:00 pm and 16:00 pm ad libitum. Lambs were fed the rations with two levels from silage of onion veins and lemon pulp mixture and the roughage concentrate ratio was 60:40%, respectively. The concentrates feed mixture (CFM) contains 14 % crud protein. The lambs had free access to water. Animal's weights were recorded biweekly then feeding rates were adjusted. Feed conversion ratio (FCR) was calculated.

Silage quality

Maize and onion veins were collected from nearby the experimental station and chopped to about 1-2 cm in length while lemon pulp was collected from factory that make juices. Chemical composition of CFM, maize silage and silage of onion veins and lemon pulp is presented in Table (1).

Table 1. Chemical composition of concentrate feed mixture (CFM), maize silage and silage of onion veins and lemon pulp.

Items	CFM	Maize silage (MS)	Onion veins and lemon pulp silage (OLS)
CP	14.27	8.11	6.98
CF	7.38	24.06	22.58
EE	3.21	2.24	1.48
Ash	6.88	6.39	8.75
NFC	42.78	25.82	26.81
NDF	32.86	57.44	55.98
ADF	20.73	28.02	25.85
ADL	2.88	4.04	4.66

Non-fibrous carbohydrates = 1000 - (Ash + CP + NDF + EE); CP: Crude protein; CF: Crude fiber; EE: Ether extract; NDF: Neutral detergent fiber; ADF: Acid detergent fiber; ADL: Acid detergent lignin.

Silage evaluation trials :

In situ dry matter degradability (ISDMD): bag technique allows intimate contact of the experimental feed with the rumen environment. Nylon bags were filled with 10g dry maize silage, onion veins and lemon pulp silage mixture. Sample then incubated in the rumen for 72h in three fistulated Barki rams (3 bags/ treatments). Bags were placed in the rumen just before the animals were fed after that bags were dried at 65°C for 48 h then analyzed for DM. The ISDMD was calculated as the loss in DM, corrected by blank.

In vitro gas production: Each maize silage, onion veins and lemon pulp silage mixture was evaluated for gas production (GP) following to (**Menke and Steingass, 1988**). The volume of gas was recorded after 24h of incubation after that values were corrected for the blank value and gas production values are expressed in mL per 200 mg DM. After 24h of incubation the final gas volume was record, 4 ml NaOH (10 M) was injected in each bottle to measure methane volume according to **Demeyer *et al.* (1988).**

Table 2. Quality of maize silage and onion veins, lemon pulp silage mixture.

Items	Maize silage (MS)	Onion veins and lemon pulp silage (OLS)
DM, g/kg	292.4	272.7
pH	4.1	4.4
NH_3-N, g/kg total-N	65.9	71.3
Lactic acid, g/kg DM	90.3	66.4
Acetic acid, g/kg DM	27.7	22.9
Butyric acid, g/kg DM	0.16	0.21

Values of metabolizable energy (ME), digestible organic matter, (DOM) for maize silage , onion veins and lemon pulp silage mixture was calculated according to **Getachew *et al.*, (2002)**, net energy for growth, (NEg) were calculated according to **NRC (1985)**. While, microbial protein (MCP) was calculated according to **Czerkawski (1985)**.

Digestibility trials:

Three mature Barki rams were used in digestibility trials in complete randomized design to evaluate silages. Rams were kept in pens individual and fed CFM, maize silage and/or silage of onion veins and lemon pulp twice daily at 8:00 and 16:00. The adaptation period was 7 days and the collection period was 7 days and the feed intake was measured daily. Representative samples of one tenth of the feces was taken daily for seven consecutive days. Feces samples were spray with diluted H2 so4 (10%) then weighed and dried at 60˚C for 24 hrs. The dried samples of feces and feeds were ground and stored for chemical analysis. Feeds and feces were analyzed for proximate analyses to determined crude protein (CP), ether extract (EE) and ash according to AOAC (2005). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADF) were determined according to Van Soest et al. (1991). Non-fiber carbohydrates (NFC) were calculated as: NFC = 1000 – CP - ash – EE – NDF according to (AOAC, 2005) and nitrogen free extract (NFE) was calculated by the difference. Total digestible nutrients (TDN) was calculated according to the classic formula of **McDonald *et al.* (1995)**.

Analysis of rumen fluid

Samples of rumen liquor were taken at the end of collection period from fistulated Barki rams before the morning feeding then strained through two layers of cheese cloth. The pH value of this sample was directly determined by using a pH meter then stored by freezing for to determine total volatile fatty acids (TVFA´s) by the stream distillation method (**Warner, 1964**). Ammonia-N Concentration was determined according to **Conway (1957)**. Individual VFA Concentration was measured by using gas-liquid chromatography (model 5890, HP, Little Falls, DE, USA).

Blood sample

Samples were collected from jugular vein puncture then placed in non-additives blood collection tubes to produce serum from a sub-sample of 3 randomly selected lambs from each experimental group at the end of the experiment. Serum was separated by centrifugation at 3000 rpm for10 min and stored at -20°C to analyze for concentration of blood plasma antioxidant enzyme such as malondialdehyde (MDA), catalase (CAT), superoxide dismutase (SOD) and glutathione (GSH) were determined using commercial kits obtained from Biodiagnostic Co., Cairo, Egypt, according to the procedure outlined by the manufacturer.

Economic efficiency:

The economic efficiency of the tested rations was expressed as the cost of feed consumption for producing one kg of daily gain of growing lambs.

Statistical analysis:

The experimental data was statistically analyzed using one-way analysis of variance according to the SAS (2005), as the following model: $Yij=\mu+Ti+eij$ Where:

Yij= experimental observation, μ = general mean of treatments, Ti = effect of treatment, eij = experimental error.

Results and discussion

Data in Table.1 illustrated proximate analysis of CFM, maize silage (MS) and onion veins and lemon pulp silage (OLS) and the silage quality. OLS showed to have less CP, CF, EE and ADF content compared to MS. But it had more Ash and ADL content; meantime it had quit similar NFC and NDF content of MS.

Table 2 showed the quality of two silages, values of pH nearly the same, this may be due to that content of DM was not highly differ so these conditions provide the microbes with substrate that suitable for their growth and producing lactic acid which case decreasing in pH (**Umam *et al.*, 2022**). Values of pH were in normal range which indicated that the two silages had good quality in fermentation. There was increase in NH3-N content, while there was decrease in Acetic acid content. **Kung *et al.*, (2018)** reported that the mechanisms which led to increase in acetic acid level are not known. However, low level of acetic acid led to inhibits yeasts growth and increase stability during feeding and exposed to air conditions. Control ration was related to be the superiority over the other ration for their GP, CH4, DOM, and MCP and in- situ degradability data (Table3).

On the contrary, ration contained 40% OLS (R3) had the less values of GP, CH4, DOM, MCP and in- situ degradability data. R2 was found to be the intermediate one. However, gas production is resulted from carbohydrate fermentation in the rumen by fibrolytic microbes. There were several bioactive components that found in onion such as organosulfur compounds, this decrease of pervious parameters may be due to supplementation with high dose of OLS that led to the inhibition in microorganism in rumen, this agreed with finding of **Mbiriri *et al.*, (2015)**. The decrease in methane production for R2 and R3 compared to the control could be resulted from organosulfur compounds which can inhibit lipid synthesis in methanogenic archaea which capture carbon dioxide and hydrogen and forming methane this agree with that reported by **Adejoro *et al.*, (2019)** who found that decreasing in in- vitro gas production due to component effect on rumen microbes. Mixture of citrus extracts and garlic decreased production of methane in all feeding diets without adverse effect on animals **Eger *et al.*, (2018).**

It well known that rumen NH3-N is the main end product of ration's protein metabolism that provide microorganism in rumen by nitrogen to form microbial protein (**Li *et al.*, 2016)**. The decrease in microbial crude protein and ME in R2 and R3 compared to control may be due to reducing the degradability of rations and this agree with the finding of **Avijit Dey *et al.*, (2021)**. There was decrease in the degradability of rations R2 and R3 which agreed with **Maghsoud *et al.*, (2022)** who reported that the materials may be had antimicrobial component which have ability to decrease degradability by decreasing microbial rumen fermentation throughout their effect on cytoplasmic membrane of microorganism or synthesis of nucleic acid.

Data in Table 4, Illustrated that all nutrients digestibility was decrease by increased level of OLS replacement and this could be as result of contained the experimental rations R2 and R3 polyphenols compounds which decrease carbohydrate and fiber digestion coefficients **Vázquez-Añón and Jenkins (2007)** .Also, this may be due to that rumen microorganisms take more time to colonize on fibers of citrus pulp. Nutritive values of rations expressed as TDN and DCP, were more ($p<0.05$) for R1 compared with both R2 and R3.

Table 3. Effects of different levels of maize silage and/or onion veins and lemon pulp silage on gas production and in situ degradability.

Items	Rations			SEM	*p* Value
	R1	R2	R3		
GP. (ml)	45.76 [a]	41.49 [b]	36.52 [c]	2.11	0.001
CH4 (ml)	5.45 [a]	5.21 [b]	4.83 [c]	0.16	0.001
DOM (%)	54.78 [a]	52.64 [b]	45.54 [c]	2.88	0.001
MCP (g/kg DOM)	66.47 [a]	62.59 [b]	55.15 [c]	1.33	0.001
ME (MJ/kg DM)	8.41 [a]	8.12 [b]	7.16 [c]	0.11	0.001
NEg (MJ/kg DM).	4.36[a]	4.19[b]	3.63[c]	0.12	0.001
In situ degradability (%)					
OMD	53.88 [a]	50.41 [b]	47.88 [c]	0.96	0.001
DMD	46.43 [a]	43.75 [b]	39.85 [c]	1.12	0.001
NDFD	42.09 [a]	40.06 [b]	37.21 [c]	0.89	0.001

[abc]Means in the same row with different superscripts differ, p<0.05.
GP: Gas production**;** DOM: digestible organic matter**;** MCP: microbial protein**;** ME: metabolizable energy; net energy for growth**;** OMD**:** Organic dry matter digestibility; DMD: Dry matter digestibility; NDFD: Neutral detergent fiber digestibility.

This may be regarding to the less of all digestion coefficients.

Data of nitrogen utilization showed that with increase of OLS percentage in rations led to decrease nitrogen intake compared with control; this may be resulted from decrease CP content in R2 and R3 ration. Results of FN were increased and this may be due to decreasing CP digestibility that makes low waste in CP content in feces. Data of NA and NR take the same trend that decrease by increase replacement and this resulted from decreasing digestibility of CP.

Rumen fermentation of sheep's fed the experimental ration is presented in table 5. Rumen PH was decreased by about 4.57 and 8.01% for R2 and R3, respectively compared to R1, this may be due to increasing level of lemon pulp in silage which led to increase acidity in rumen **Lenehan *et al.* (2017)** reported that if ration contained sugars and pectin (such as citrus) in high concentration, this was more efficient to reduce pH compared to that with high level of fibers. Ammonia nitrogen concentration was decrease in R2 and R3 more in due to increasing available energy which came from lemon pulp that help microflora to use ammonia-N and this cause decreasing ammonia-N in rumen this result was agreed with **Novozamsky *et al.* (1974).** Also, concentration of total VFA and propionate was decreased with increasing level of OLS in ration. But concentration of butyrate and Acetate /Propionate ratio was increased, this agreed with the finding of Ma et al. (2016).

Table 6 Showed values of Serum antioxidant enzyme for lambs fed on tested rations; the main importance of endogenous antioxidant system is control on ROS (Reactive Oxygen Species) level in the body (**Sugiharto *et al.*, 2016**). Enzyme of Endogenous antioxidant can remove the excessive of ROS to save health. Also, data showed that there was decreasing in Malondialdehyde by increased level of OLS in ration this agree with that reported by EI-Naggar and Ibrahim, (2018) who found that

Table 4. Nutrient digestibility, Nutritive values and Nitrogen utilization of Barki lambs fed rations containing maize silage and/or onion veins and lemon pulp silage

Items	Rations			SEM	*p*Value
	R1	R2	R3		
Nutrient digestibility, %					
DM	63.38 [a]	61.79 [b]	58.38 [c]	0.86	0.001
OM	65.85 [a]	62.66 [b]	59.86 [c]	1.06	0.001
CP	64.01 [a]	60.72 [b]	54.09 [c]	1.21	0.001
CF	60.51 [a]	55.26 [b]	51.72 [c]	1.17	0.001
EE	78.29 [a]	77.37 [a]	71.08 [b]	0.95	0.004
NFE	66.83 [a]	62.39 [b]	61.98 [b]	0.47	0.013
NDF	59.53 [a]	56.26 [b]	51.11 [c]	1.74	0.001
ADF	53.16[a]	50.47 [b]	47.31 [c]	0.89	0.001
ADL	41.06 [a]	39.76 [b]	36.03 [c]	0.75	0.001
Nutritive values, %					
TDN	64.45 [a]	59.61 [b]	57.97 [c]	0.93	0.001
DCP	7.46 [a]	6.69 [b]	6.31 [c]	0.26	0.001
Nitrogen utilization					
NI , g/d	20.34 [a]	18.87 [b]	17.85 [c]	0.68	0.001
UN, g/d	5.12 [a]	5.39 [a]	4.58 [b]	0.22	0.008
FN, g/d	7.32 [b]	7.41 [b]	8.19 [a]	0.27	0.014
NA	13.08 [a]	11.46 [b]	9.66 [c]	0.84	0.001
NR	7.89 [a]	6.06 [b]	5.08 [c]	0.72	0.001
NR/N intake	38.84 [a]	32.13 [b]	28.45 [c]	1.22	0.001
NR/N Absorbed	60.68 [a]	52.91 [b]	52.59 [b]	0.67	0.017

[abc]Means in the same row with different superscripts differ, p<0.05.

CP: crude protein; CF: crude fiber; EE: Ether extract; NDF: Neutral detergent fiber; ADF: Acid detergent fiber; ADF: Acid detergent lignin; TDN: Total digestible nutrients; DCP: Digestible crude protein; NI: Nitrogen intake; UN: Urea nitrogen; FN: Feces Nitrogen: NA: N-Absorbed; NR: N-Retention

Table 5. Rumen fermentation of Barki lambs fed rations containing maize silage and/or onion veins and lemon pulp silage

Items	Rations			SEM	*p* Value
	R1	R2	R3		
pH	6.34[a]	6.05 [b]	5.83 [c]	0.11	0.001
NH3- N, mg/ 100 ml	12.65 [a]	11.18 [b]	9.77 [c]	0.62	0.001
Total VFA, mmol/L	61.57 [a]	59.44 [b]	57.15 [c]	0.74	0.001
Acetate, mmol/L	59.49 [a]	57.77 [b]	54.84 [c]	0.58	0.001
Propionate, mmol/L	23.64 [a]	20.73 [b]	18.55 [c]	0.34	0.001
Butyrate, mmol/L	7.64 [c]	8.76 [b]	9.04 [a]	0.14	0.001
Acetate to propionate ratio	2.52 [c]	2.79 [b]	2.96 [a]	0.07	0.001
Bacterial counts, count/ ml x 10^8	6.85	7.01	7.11	0.25	0.737
Protozoal counts, count/ ml x 10^5	3.86	3.56	3.31	0.74	0.844

Table 6. Serum antioxidant activities of Barki lambs fed rations containing maize silage and/or onion veins and lemon pulp silage.

Items	Rations			SEM	*p* Value
	R1	R2	R3		
MDA, nmol/mL	2.64[a]	1.55[b]	1.24[c]	0.12	0.001
CAT, U/mL	2.87[c]	3.95[b]	4.21[a]	0.15	0.001
SOD, U/mL	96.86[c]	112.64[b]	125.55[a]	2.06	0.001
GSH, U/mL	118.76[c]	132.98[b]	147.35[a]	3.86	0.001

MDA: Malondialdehyde; CAT: Catalase ; SOD: Superoxide dismutase; GSH: Glutathione

supplemented garlic powder or cumin powder to growing lambs ratio had effect on Serum antioxidant enzyme . While there was increasing in CAT, SOD and GSH in R2 and R3 compared to control, and that agreed with the finding of **Redoy et al. (2020),** also, **Ali Mojtahedin et al. (2016)** showed that lemon essential oil had antioxidant activity to remove of free radicals when supplemented to ration of Afshari Ewes.

Table 7 showed the growth performance of lambs feed tested rations, there was significant decrease in silage intake and total DMI in treated groups compared with control group, this decreasing by OLS increase percentage in the ration may be due to increase sulphur compounds in R2 and R3 that decrease the apatite of animals, this agrees with finding of (**Canbolat *et al.*, 2021**). The final weight of lambs showed significant decrease by 13.32 and 17.94% for R2 and R3, respectively compared to R1 and this due to the decrease DMI. ADG in R2 and R3 by about 20.85 and 32.97% respectively compared to control. This could be explained as nutrient digestibility and microbial protein for ration with replacement. While, FCR was increase by 15.61 and 29.04% for R3 and R2 compared to R1and this regarding to increasing average daily gain for R1.

Calculation based on the following price in Egyptian pound (L.E.) per ton at 2022, concentrated feed mixture (CFM) =15500 L.E/ton, maize silage =950 L.E/ton, onion veins and lemon pulp silage =780. The price of one kg of live body weight was 125 L.E.

Daily feed cost was decreased by increase level OLS, this for sure due to the decrease costs of OLS silage materials compared to maize silage. Net revenue showed decrease by 35.85 and 56.42%, respectively compared to R1.also, economic efficiency was decrease by replacement.

Table 7. Feed intake, average daily weight gain (ADG), feed conversion ratio (FCR) and economic efficiency of Barki lambs fed rations containing maize silage and/or onion veins and lemon pulp silage

Items	Rations			SEM	*p* Value
	R1	R2	R3		
Feed intake, g/d					
No. of animals	10	10	10	-	-
CFM intake	628.25	628.25	628.25	0.00	0.00
Silage intake	461.77[a]	367.38[b]	314.17[c]	34.25	0.011
Total DMI	1090.02[a]	996.64[b]	942.42[c]	41.07	0.006
Growth performance					
Initial weight (kg)	22.75	22.92	23.07	0.15	0.759
Final weight (kg)	52.09[a]	45.15[b]	42.74[c]	1.65	0.001
ADG (g/day)	195.66[a]	154.85[b]	131.15[c]	8.46	0.001
FCR	5.57[c]	6.44[b]	7.19[a]	0.73	0.001
Net revenue (LE)	13.22	8.48	5.76		
Economic Efficiency	2.18	1.78	1.54	-	-
Relative economic efficiency	100	0.82	0.71	-	-

[abc]*Means in the same row with different superscripts differ, p<0.05.*
DMI: Dry matter intake; ADG: Average daily gain; FCR: Feed conversion ratio.

Conclusion

It is possible to benefits from substitution silage of onion and lemon pulp mixture instead of MS silage by limited percent to reduce feeding cost and obtaining a relatively reasonable return, especially with the matching dates for harvesting corn and onion, while demons are available through the year, although reducing the replacement rates to less 50% may be more profitable, especially in areas where it's preferable to direct corn production to oil production or poultry production.

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تاثير استبدال سيلاج الذرة بسيلاج مخلوط عروش البصل و تفل الليمون على كفاءة الانتاج فى المجترات الصغيرة

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الملخص العربى

تم استخدام 30 حمل عمر 5 شهور بوزن (22.90 ± 0.15كجم) و قسمت على ثلاثه مجاميع عشوائيا (عشرة حيوانات لكل مجموعه) و كانت مدة التجربه خمسه اشهر. العلف المصنع المركز و سيلاج الذرة وسيلاج مخلوط عروش البصل و تفل الليمون كانت تقدم مرتين يوميا. ول كانت نسبه العلف المصنع الى السيلاج 40:60% على التوالى . كانت نسبه البروتين فى العلف المصنع 14% . و كانت المجموعه الاولى تتغذى على 60%العلف المصنع 40% سيلاج الاذرة (كنترول) ؛ المجموعه الثانيه تتغذى على 60 % علف مصنع و 20 % سيلاج ذره+20 % سيلاج مخلوط عروش البصل و تفل الليمون اما المجموعه الثالثه فكانت تتغذى على 60 % علف مصنع و 40 % سيلاج مخلوط عروش البصل و تفل الليمون و اشارت النتائج بالنسبه للسيلاج ان قيم رقم الحموضه فى المعدل الطبيعي بينما كان هناك زيادة فى مستوى الامونيا و انخفاض فى مستوى حمض الاستيك لسيلاج مخلوط عروش البصل و تفل الليمون. عليقة الكنترول تفوقت على باقى العلائق بالنسبه لانتاج الغازات و الميثان و البروتين الميكروبي و الهضم المعملي . كل ايضا هناك انخفاض فى معدل النمو اليومي بينما كانت هناك زياده فى معدل التحويل الغذائى . من الممكن استبدال سيلاج الذرة بسيلاج مخلوط عروش البصل و تفل الليمون بنسبه 50% لتقليل التكلفه و لكن للحصول على افضل النتائج دون التاثير على صحه وانتاج الحيوان يجب تقليل نسبه الاستبدال.