EFFECT OF REPLACEMENT OF CLOVER HAY BY DIFFERENT LEVELS OF *PANICUM MAXIMUM* ON REPRODUCTIVE PERFORMANCE OF V- LINE RABBIT DOES

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SUMMARY

Twenty V-line rabbit does aged 5 months, weighing about 2.925.6 ± 6.69 kg were used in the present experiment to evaluated the effect of different levels of *Panicum maximum* 15, 30 and 45% replacement of clover hay on reproductive performance of rabbit does. Rabbit does were randomly distributed -into 4 groups. Group (1) fed control diet, group (2), group (3) and group (4) were fed 15%, 30 and 45% *Panicum maximum* respectively, replacement of clover hay. Results could be summarized as follows:

1- Change in weight of the does were significantly decreased with 15% and 30% *Panicum maximum* feeding diets during gestation period compared with control, while change in weight at pregnant insignificantly differed to control when replacing 45% *Panicum maximum* to clover hay.

2- Feed intake was significantly increased with replacing different levels of *Panicum maximum* at pregnant period and replacing 30 and 45% panicum at lactating does.

3- Litter weight and litter weight gain of kids with rabbits fed diets containing 45% *panicum maximum* at week$_1$ until week $_4$ were close to data of litter weight with rabbit fed control. Mortality rate was not significantly different between different treatments.

4- Inclusion of 45% *Panicum maximum* significantly recorded the highest milk yield during the four weeks of lactation compared with others groups, litter weight and litter weight gain and the highest economical efficiency. Conclusively, it is possibility to replace 45 % of clover hay by *Panicum maximum* of the rabbit does diets.

Keywords*: Panicum maximum, clover hay, rabbit does and diets.*

INTRODUCTION

Panicum maximum (guinea grass) is naturally grown in Africa. Also, it is indigenous to the subtropical areas of southern Africa where it occurs mainly in the sub habitat under trees (Pieterse *et al*., 1997).

The quality of available bites is depressed when green leaf material is scarce and largely dispersed among senescent material especially in the case of older pasture for which the NDF and ADL fractions increased with level of maturity .The nitrogen content (CP) of pasture also decreased from the young to mature stages. Variation in the proximate composition of *Panicum maximum* var trichoglume . Eyles based on stage of growth and location of pasture (FAO, 2003). It dies if continually grazed close to the ground and needs rest late in the growing season. (FAO, 2003). Reling *et al.* (2001) concluded that increased pasture maturity had a negative effect on the nutritional value of P. maximum. Aganga and Tshwenyane (2004) showed that in vitro digestibility for sheep of *Panicum maximum* decreased with

level of maturity an all seasons except winter in agreement with reports that a decrease in N content and an increase in NDF, ADF and ADL content are associated with a decrease in digestibility (Cilliers and Van der Merwe, 1993). Miegoue *et al.* (2018) found that *Panicum maximum* contained DM; 91.76, OM; 85.88, CP; 13.45, CF; 33.08, EE; 2.67 and ash 14.12%, respectively. Ezea *et al.* (2014) found that better weight gain of pregnant rabbits and better weight litters compared to control group when pregnant rabbit fed concentrate plus mix of forage (containing *Panicum maximum*). Udeh *et al.* (2007) found that rabbits the highest feed intake with rabbits fed *Panicum maximum* compared with other forage as Centrosema pubescens and Sida acuta. Guinea grass is used as forage for beef production. It is used as a cultivated grass both for pasture and hay (Aganga and Tshwenyane, 2004). Guinea grass (*Panicum maximum* Jacq.) has been used for more intensive cattle production systems Fernandes *et al.* (2014).

Hence, the aim of the study is to investigate the effect of partial replacement of clover hay by *Panicum maximum* on reproductive performance, and economical efficiency of rabbit does.

MATERIALS AND METHODS

This study was carried out at, Elsero, Station Demeta Governorate, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. Panicum was obtained from Alexandria dessert road, Egypt farm, it was dry in sun until complete drying and ground by hammer mill and kept for chemical analysis before mixing into the experimental diets.

The experimental design:

Four experimental diets were formulated; the first used as control diet without panicum while the other three diets were incorporated by *Panicum maximum* at 3.00, 6.00 or 9.00 % levels in the diet replacing (15, 30 or 45% of clover hay) of rabbit does diets as shown in Table (1). A total number of 20 V-line rabbit does age 5 months, weighing about 2.925.6 ± 6.69 kg were randomly distributed individually into 4 experimental treatments (5 does/ treatment). Mating was achieved by 4 adult V-line bucks aged 6 months with 3.0 kg average body weight, with good fertility records. Bucks were fed on control diet. Does were naturally inseminated. Detection of conception was carried out by palpation at 10 days after mating and the non pregnant were remitted immediately. Does were housed in individual wired-cages. All animals were kept under the same management and hygienic conditions and provided with fresh water and pelleted diets, *ad-libtum* over the experimental period.

Experimental diets and measurements:

All experimental diets were formulated to be iso-nitrogenous and iso-caloric, and to meet all the essential nutrient requirements of rabbit does according to (Agriculture Ministry Decree, 1996). The chemical analysis of the experimental samples of diets, *Panicum maximum* and clover hay were done according to the conventional methods of AOAC (2000). Chemical analyses of *Panicum maximum* and clover hay are presented in Table (2). The digestible energy (DE kcal /kg) of *Panicum maximum* determine in the 1st experiment, six male V-line rabbits at 14 weeks of age were feeding each rabbit with 240 g (120 g clover hay + 120 g *Panicum maximum*) for seven days during which the feces were collected daily sprayed with 2% boric acid solution for trapping any ammonia released from feces. At the end of this period, where, feed intake was calculated and feces were dried at 60^{o} C for 48 hours (till constant weight), finely ground and thoroughly mixed to ensure sample uniformity and then stored until ~~being~~ analyses according to the official methods (AOAC, 2000) for gross energy determination. Does weight, feed intake, litter size and weight at birth and weekly up to weaning were recorded. The change in live body weight during gestation period was calculated as the difference between the live body weight at weekly after kindling using the weight-suckle-weight technique described by McNitt and Lukefahr (1990). In this method, the kids of each doe were separated from their dams by closing the gates between the nest box, at night. In the morning before does feed the kids weights were recorded and the does, then were allowed to feed the kids and body weights were recorded again. Milk yield was determined and recorded as the difference in the weight pre-and post-suckling. Weekly milk yields at 7 days (MY7), 14 days (MY14), 21 days (MY21) and 28 days (MY28) were calculated as the mean of milk amount estimated in this week, and then multiplied by 7 to get the weekly milk yield. Total milk yield (TMY) of the first three weeks of suckling (TMY 21) was calculated by adding total amount of each week of the to get the total milk yield from birth up to 21 days. Mortality rate (MR) for kids during lactation was calculated as:

MR of kids = ((No. Kids born alive – No. Kids at weaning)/ (No. Kids born alive)) X 100

Table (1): Ingredients and chemical composition of experimental diets.

Item	Control	*Panicum maximum*		
		15%	30%	45%
Clover hay	20.00	17.00	14.00	11.00
Panicum maximum	-	3.00	6.00	9.00
Yellow corn	21.25	21.22	21.02	21.02
Wheat bran	29.25	29.05	29.05	29.05
Soybean meal (44%)	22.30	22.30	22.30	22.30
Lime stone	0.24	0.24	0.24	0.24
Di calcium phosphate	3.00	3.00	3.00	3.00
Sodium Chloride (NaCl)	0.50	0.50	0.50	0.50
Vit.& min. Mix*	0.30	0.30	0.30	0.30
DL-Methionine	0.14	0.14	0.14	0.14
Anticoccidia (Diclazuril)	0.05	0.05	0.05	0.05
Molasses	3.00	3.00	3.00	3.00
Total	100	100	100	100
Calculated analysis%[1] :				
CP%	18.31	18.27	18.24	18.,23
CF%	11.32	11.32	11.34	11.36
EE%	2.77	2.74	2.75	2.77
NFE%	57.57	57.12	57.42	57.44
Ash%	10.03	10.55	10.25	10.20
DE kcal/kg	2602.5	2602.6	2601.4	2606.8
Calcium	1.20	1.21	1.23	1.20
Total phosphorus	1.05	1.00	1.12	1.11
Methonine	0.43	0.42	0.42	0.42
Lysine	1.05	1.00	0.99	0.99

** Each per 1 kg diet: 6000 IU Vit. A; 900 IU, Vit.D_3; 40 mg, Vit. E; 2.0 mg, Vit. K_3; 2.0 mg Vit., B_1; 4.0 mg , Vit. B_2; 2.0 mg, Vit. B_6; 0.010 mg, Vit. B_{12}; 5.0 mg, Vit. PP; 10.0 mg Vit., B_5; 0.05 mg, B_8; 3.0 mg, B_9; 250 mg, Choline; 250.0 mg, Fe;50.0 mg, Zn; 8.5 mg Mn; 5.0 mg Cu; 0.20 mg I, and 1 mg Se.*

[1] *According to Feed composition for animal and poultry feed stuff used in Egypt (2001).*

Economic efficiency:

The economic efficiency of experimental diets was calculated as the ratio between income (litter size x selling price of each rabbit at weaning) and cost of feed consumed according to Soliman *et al*. (2012).

Statistical analysis:

The experimental data were analyzed using general linear model using – ANOVA procedures of SAS (2004) by the following model: $Y_{ij}= \mu+T_i+e_{ij}$.

Where: μ= overall mean of Y_{ij}, T = effect of treatment, i = (1, 2…, etc) and e_{ij} = experimental error.

The Significant differences among treatment means were separated at alpha level ($P\leq0.05$) by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition:

As shown in Table (2), chemical analyses of *Panicum maximum* compared with clover hay revealed that, CP was (11.65 vs. 12.00), CF (9.18 vs. 5.72), EE (4.43 vs. 2.60), NFE (67.73 vs. 76.74), ash (13.54 vs. 2.54) ,DE (2647 vs.2758), Ca (0.415 vs.1.40), P (0.16 vs.0.23) and tannin (1.73 vs. 3.53) and in Table (3) amino analysis in *Panicum maximum* compared with clover hay indicated that lysine (0.49 vs. 0.54) methionine was (0.16 vs.0.18) and therionine (0.34 vs.0.51). In this respect, Medugu *et al*. (2012) found

that *Panicum maximum* contained CP (10.5%), CF (30.4%), EE (2.5%) ash (7.5%). Miegoue *et al.*, (2018) found that *Panicum maximum* contained 91.76, 85.88, 13.45, 33.08, 2.67 and 14.12% as DM, OM, CP, CF, EE and ash, respectively. Monica and Anthonia (2016) found that *Panicum maximum* contained DM (37.0%), CP (10.5%), CF (30.4%), EE (2.5%) ash (7.5%, and 48.7(NFE).

Table (2): Chemical composition of *Panicum maximum* and clover hay (on DM basis).

Item	Chemical analysis (on DM basis)									
	OM %	CP %	CF %	EE %	NFE %	Ash %	DE (Kcal/kg)	Tannins %	Ca	p
P. maximum	86.90	11.65	30.66	2.76	41.83	13.1	1959	1.73	0.41	0.16
Clover hay	91.20	12.00	30.00	2.10	47.10	8.80	1780	3.53	0.25	1.40

Table (3): Amino acids analysis of *Panicum maximum* and clover hay.

Amino acids	*Panicum maximum*	Clover hay
Lysine	0.49	0.54
Methionine	0.16	0.18
Therionine	0..34	0.51

Doe performance:

Data in Table (4) showed that effect of treatments on doe weight at mating, pregnancy and change in weight and feed intake (g/day) at pregnancy and suckling. It is noticed that doe weight at mating, pregnancy and change in weight at suckling were not affected by experimental treatments. However, change in weight at pregnant were significantly decreased with 15% and 30% *Panicum maximum*

Table (4): performance of rabbit does as affected by experimental treatments.

Item	Control	Experimental group			SEM
		15%	30%	45%	
Does weight of mating	2935.3	2921.6	2920.0	2925.5	6.69
Does weight of Pregnant	3071	3052	3045	3091	10.71
*Change in weight (g)	165.0^{ab}	128.7^{b}	125.0^{b}	175.0^{a}	8.46
Does weight of suckling	2773.3	2730.3	2746.6	2751.3	10.09
**Change in weight (g)	-162.0	-191.3	-173.4	-174.2	5.16
Feed intake (g/d)					
Pregnant does	196.0^{b}	220.0^{a}	197.9^{b}	182.93^{c}	4.10
Lactating does	267.43^{b}	298.21^{a}	230.65^{c}	245.34^{c}	8.19

**Change in weight (g) = Pregnant weight g) - Mating weight (g).*
***Change in weight (g) = Suckling weight (g) - Mating weight (g).*
a, b and c: Means in the same row with different superscripts are significantly different (P≤0.05).

compared with control, while change in weight at pregnant close to control when replacing 45% *Panicum maximum* to clover hay. Feed intake was significantly increased with replacing 15, 30 and 45% *Panicum maximum* at pregnant does and replacing 30 and 45% *Panicum maximum* at lactating does. In this respect, Ezra *et al*. (2014) concluded that pregnant rabbit fed concentrate plus mix of forage (concentrate + mixed forages of Calopogonium mucunoides, Centrosema pubescens, Tridax procumbens, *Panicum maximum* and Gomphrena spp. recorded better weight gain of pregnant rabbits. Monica and Anthonia (2016) found that final weight and weight gain were higher with rabbit doe fed on control diet without forage followed by those fed on diet containing forage 50% Calopogonium mucunoides and 50%–*Panicum*

maximum) and the least was in those fed on diet containing 0% Calopogonium mucunoides and 100% *Panicum maximum*). While, daily feed intake was highest for does on diet containing concentrate and forage (0% Calopogonium mucunoides and 100% *Panicum maximum*). Rufino *et al,* (2012) found that supplementation of *Panicum maximum* up to 1.5% live weight in concentrate for Anglo Nubian goats doe increased the feed intake of dry matter and increased the live weight.

Milk yield:

Results in Table (5) showed that does fed dietary inclusion of 45% *Panicum maximum* recorded significantly the highest milk yield during the four weeks of lactation compared with others groups. However, the does fed 15, 30% *Panicum maximum* recorded significantly lower of milk yield during the three weeks period, on the other hand, there was an insignificant decrease in milk yield at the replacement of 30% *Panicum maximum* during first week compared to control groups. In these respect, Rufino *et al*., (2012) found that supplementation of *Panicum maximum* up to 1.5% live weight in concentrate for anglo nubian goats doe increased milk yield. Gaafar *et al*., (2014) found that rabbit does fed on fibrous diets during lactation increased milk production. Also, the results confirmed with Chrastinova *et al. (*1997) who reported that milk yield of rabbits gradually increased until 21th day of lactation; afterwards it decreases by next 10 days. However, Abo-El-Ezz *et al*.,(1981) mentioned that the milk yield increased by increasing the litter size. Ali *et al*., (2017) found that milk yield with Baladi black rabbits doe fed on 15 or 30 % conocarpus replacement of berseem hay close to milk yield with Baladi black rabbits does fed on control diet without conocarpus. Also Basyony *et al.* (2019) found that milk yield, during lactation periods at 2nd, 3rd and 4th week significantly increased for rabbit does fed 10.75 Salix Safsaf + 23.25 berseem hay Kg/100 Kg compared to those fed the control diet.

Table (5): Milk yield affected by experimental treatments.

Suckling period	Control	Experimental group			SEM
		15%	30%	45%	
Week 1	76.60^{ab}	64.13^{b}	71.26^{ab}	80.32^{a}	2.45
Week2	121.21^{a}	94.02^{c}	105.60^{b}	124.30^{a}	3.79
Week3	140.02^{a}	111.00^{c}	122.12^{b}	140.93^{a}	3.72
Week4	123.54^{a}	97.12^{b}	101.20^{b}	118.43^{a}	3.61

$^{a, b \text{ and } c}$ *Means in the same row with different superscripts are significantly different(P≤0.05).*

Litter performance and mortality rate:

Data of litter size at birth, litter size at weaning, litter weight, litter weight gain-and mortality rate were illustrated in Table (6). The incorporation of 30% and 45% *Panicum maximum* in rabbit diets showed insignificant effect on litter size at birth (total), litter size at birth (live), 21day, 28day and weaning for 30 or 45% *Panicum maximum* compared to control. However, litter size at birth (total), litter size at birth (live), 21day, 28day and weaning were significantly decreased for rabbits fed 15% *Panicum maximum* compared to control. Litter weight at birth was not affected by treatments and data of litter weight and litter weight gain of kids with rabbit fed diets containing 45% *Panicum maximum* at week$_1$ until week $_4$ were close to data of litter weight of kids with rabbits fed control. However, inclusion of 15 or 30 % *Panicum maximum* significantly decreased litter weight of kids compared to control and 45% *Panicum maximum*. Litter weight gain of kids were significantly decreased with diets containing 15% *Panicum maximum* compared to control and other treatments in week$_1$ and week $_3$ and litter weight gain of kids for inclusion of 15 and 30% *Panicum maximum* compared with control and 45% *Panicum maximum* in week $_2$. While, litter weight gain of kids was not effected by different treatments in week $_4$. Mortality rate was not significantly different between different treatments. In these respect, Monica and Anthonia (2016) found that the highest litter size at birth and litter size at weaning for does on fed diet containing forage 50% Calopogonium mucunoides and 50%% *Panicum maximum*, followed by those on diets 25% Calopogonium mucunoides and 75% *Panicum maximum* and the least for those on diet 0% Calopogonium mucunoides and 100% *Panicum maximum*. Mortality rate before weaning was higher for doe fed diet containing 0% Calopogonium mucunoides and 100% *Panicum maximum* while no mortality with those fed diet containing 50% Calopogonium mucunoides and 50% *Panicum maximum*. These results agree with Ali *et al*., (2017) who found that baladi black rabbit does fed on 15 or 30 % conocarpus replacement of berseem hay were significantly decreased litter size at 21day, 28day and weaning compared to control without conocarpus and the same author also, found that significantly higher

mortality rate when rabbit does fed 15 and 30% conocarpus compared to rabbit fed control diets. Ezea *et al*. (2014) concluded that litter birth weights (kg) were significantly increased when rabbits fed concentrate plus mix of forage (concentrate + mixed forages of Calopogonium mucunoides, Centrosema pubescens, Tridax procumbens, *Panicum maximum* and Gomphrena spp.) compared to control. Basyony *et al.,* (2019) found that average litter weight at weaning and weight gain increased for rabbit does fed basal diet contained 10.75 Salix Safsaf + 23.25 berseem hay Kg/100 Kg. and rabbit does fed diet contained basal diet contained 17 Salix Safsaf + 17 berseem hay Kg/100 Kg compared to rabbis fed control diet and rabbits fed basal diet contained 23.25 Salix Safsaf + 10.75 berseem hay Kg/100Kg.

Table (6): Litter performance and mortality rate affected by experimental treatments.

Item	Control	Experimental group			SEM
		15%	30%	45%	
Litter size					
Birth (total)	8.00	7.86	7.90	8.00	0.03
Birth (live)	7.85^{a}	6.45^{b}	7.60^{a}	7.74^{a}	0.20
21 days	7.34^{a}	6.21^{b}	7.00^{ab}	7.43^{a}	0.20
28 days	7.00^{a}	6.18^{b}	6.80^{ab}	7.00^{a}	0.13
Weaning	6.10^{a}	5.00^{b}	6.20^{a}	6.40^{a}	0.20
Litter weight (g):					
At birth	331.7	236.7	263.3	333.7	41.28
Week 1	757.3^{a}	617.0^{b}	665.3^{b}	748.3^{a}	18.8
Week 2	1466.0^{a}	1085.0^{b}	1197.0^{b}	1430^{a}	53.13
Week 3	1870.0^{a}	1373.0^{c}	1593.0^{b}	1850.0^{a}	65.10
Week 4	2747.3^{a}	2141.7^{c}	2393^{b}	2710.0^{a}	77.63
Litter weight gain (g):					
Week 1	425.6^{a}	380.3^{b}	402.0^{ab}	414.6^{a}	7.42
Week 2	708.7^{a}	468.0^{c}	531.7^{b}	681.7^{a}	31.35
Week 3	404.0^{a}	288.0^{b}	396.0^{a}	420.0^{a}	18.39
Week 4	877.3	768.7	800.00	860.0	26.12
Mortality rate%					
Kids (from birth till weaning)	22.22	22.48	18.42	17.31	1.31

^{a,b} and ^{c}: Means in the same row with different superscripts are significantly different (P≤0.05).

Economic efficiency:

Results in Table (7) indicated that the lowest total feed cost /doe (LE.) (48.46 LE) was observed with rabbits fed the diets containing 15% *Panicum maximum*. Results indicated that groups fed diets 45% *Panicum maximum* achieved the highest economic efficiency (1.50) and relative economical efficiency (101.35) followed by a decreasing order by groups fed control and the least was the group fed 15% *Panicum maximum*. Basyony *et al*. (2019) found that economic efficiency was the best for doe rabbit fed 50% Salix Safsaf replacement with berseem hay.

Table (7): Effect of experimental treatments on economic efficiency of rabbit does.

Item	Control	Experimental Groups		
		15%	30%	45%
Price/kg diet	3.82	3.77	3.72	3.67
(Total feed consumed doe/gestation period/kg)	5.487	5.937	6.600	5.880
(Total feed consumed doe/suckling period/kg)	7.360	6.919	8.946	8.022
Total feed cost /doe (LE)	49.07	48.46	57.83	51.02
Litter size at weaning	6.10	5.00	6.20	6.40
Total revenue/Litter at weaning (LE)[1]	122.00	100.00	124.00	128.00
Net revenue/doe (LE)[2]	72.93	51.54	66.17	76.98
Economic efficiency (LE)[3]	1.48	1.063	1.144	1.50
Relative economic efficiency	100	71.86	77.31	101.35

[1]Total revenue = Litter size x20, assuming that the selling price of each rabbit at weaning was LE (20).
[2]Net revenue/ rabbit doe (LE) = Total revenue/ rabbit doe (LE) - Total feed cost / rabbit doe (LE).
[3]Economic efficiency = Net revenue/ rabbit doe/ Total feed cost / rabbit doe (LE).

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تأثير إستبدال دريس البرسيم بمستويات مختلفة من نبات البونكيام ماكسميم على الأداء التناسلى لأمهات أرانب فالين

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أستخدم فى هذه الدراسة 20 أم فالين عمر 5 شهور بمتوسط وزن 2.925.6 ±6.69 كجم لتقيم تأثيرأحلال مستويات مختلفة من بونكيام ماكسميم 15, 30 و 45 % محل دريس البرسيم على الأداء لمهات الأرانب. وزعت أمهات الأرانب عشوائيا الى 4 مجاميع، المجموعة الأولى تم تغذيتها على عليقة كنترول والمجموعات الثانية والثالثة والرابعة على علائق احتوت على 15 , 30 و 45% بونكيام ماكسميم أحلال من دريس البرسيم بعلائق الأرانب. و قد لخصت النتائج كالتالى:

1- وجد نقص معنوى فى التغير فى وزن الجسم لأمهات الأانب فى فترة الحمل مع 15 , 30 بونكيام بالمقانة بالكنتول . بينما كان التغي فى وزن الجسم يتقاب مع الكنترول مع الأحلال بنسبة 45% بونكيام من دريس البرسيم.

2- وجد زيادة معنوية فى الغذاء المأكول مع أحلال البونكيام بنسبة المختلفة فى فترة الحمل والأحلال بنسبة 30 و 45 % فى فترة الرضاعة.

3- وزن الخلفة ووزن الخلفة المكتسب مع الأرانب التى غذيت على 45% بونكيام يتقارب مع وزن الخلفة المكتسب مع الأرانب التى غذيت على للكنترول ولايوجد فرق معنوى فى معدل النفوق.

4- سجلت كمية اللبن زيادة معنوية أثناء الأسابيع الأربعة فى فترة الرضاعة بالمقارنة بالمجاميع الأخرى وتم تسجيل أعلى كفاءة أقتصادية فى المجموعة المغذاة على الأحلال بنسبة 45% بونكيام.

الخلاصة أمكانية أحلال البونكيام حتى مستوى 45% من دريس البرسيم بعلائق أمهات الأرانب.