

## **Sprouted *zea mays* on date palm leaves and potatoes peel waste mixture and its effects on performance of desert goats under dry season in Sinai.**

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### **ABSTRACT**

The objectives of this study were to evaluate Sprouted techniques by planting white corn seeds (*Zea Mays L.*) on four roughage mixtures of date palm leaves (*Phoenix dactylifera L.*) and potatoes peels waste (*Solanum tuberosum*). Twenty five desert male goats averaged (eighteen months old)  $22.76 \pm 1.29$  kg live body weight were divided randomly into five equal groups (5 animals each) to receive one of the following experimental roughages R1: alfalfa (*Medicago sativa*) hay (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) and R5: 100% date palm leaves (DPL). Goats were used in feeding trial lasted about forty five days. The metabolism trial was conducted after the feeding trial to get the most nutritious sprouts green fodder (SGF) with concentrate feed mixture (CFM).

Results showed that sprouting corn seeds on potatoes peel waste (PPW) and date palm leaves (DPL) as a media had increased CP, EE, C.CHO and ash contents while decreased OM, CF, NDF and ADF contents as compared with none sprouted media. Sprouted corn seeds on PPW or DPL revealed a significant ( $P \leq 0.05$ ) improvement in digestibility coefficients of DM, EE and C.CHO. Nutritive values expressed as TDNg/Kg B.W. and DCP% increased significantly ( $P \leq 0.05$ ) in sprouted mixtures as compared with control (R1). Goats fed R3 had ( $P \leq 0.05$ ) lowest total feed intake and highest digestibility coefficients of DM, CP, EE, C.CHO and DCP. Also, goats fed the treated mixture R3 retained higher ( $P \leq 0.05$ ) nitrogen values and nitrogen intake comparable with other studied groups. Goats fed sprouted mixtures had improved ( $P \leq 0.05$ ) values of total water intake and decreased urinary water excretion. Sprouted corn seeds had improved Na and K balances (g/kg BW) as compared with control group (R1). Goats fed sprouted mixtures had significantly higher ( $P \leq 0.05$ ) values of total volatile fatty acids (VFA), ruminal ammonia ( $\text{NH}_3\text{-N}$ ), serum total proteins, albumin, globulin, urea and creatinin compared with control group. In conclusion we can produce green fodder by utilizing dried potatoes peel waste (PPW) and date palm leaves (DPL) as a media mixture (50% PPW and 50% DPL) by simple methodology using sprouts corn without any harmful effect on desert goats under dry season.

**Keywords:** Sprouted corn seeds, date palm leaves, potatoes peel waste, goats, digestibility, nutritive values, rumen and blood parameters.

### **INTRODUCTION**

The available amount of green fodder through the summer season in Egypt is usually insufficient for animal feeding leading to increasing prices of diets. Therefore, attempts have been carried out to search for alternative non-conventional low price by-products, which could be used in animal feeding.

Moreover, 21 million tons of agricultural crop residues are produced in Egypt annually (Deraz, 1996). However, only 4.0 to 4.3 million tons of these crop residues are used for feeding animals (Hathout and El-Nouby, 1990 and Khorshed, 2000).

Fibrous crop by-products or farm wastes are characterized by extensive lignification of the cellulose and the hemicellulose, and by low levels of protein, soluble carbohydrates and minerals (Van Hao and Ledin, 2001). One of these wastes is date palm and mid rib of date palm tree species (*Phoenix dactylifera* L.). It was generally known that date have a fundamental economic importance in many desert areas especially in south Sinai governorate in Egypt. Date fruit production yields several crop residues: date palm leaves (fronds), leaf petioles, racemes (without the dates) and the pedicels. Date palm leaves and their petioles can be used to feed livestock. They are used traditionally as a complementary feeding source by oasis dwellers Medjekal *et al.* (2011). A date palm tree can produce 13.5-20 kg of dry fronds annually Pascual *et al.* (2000).

The production of potato food products generates large amount of by-product material which has potential to be used as feed sources for ruminants. Approximately 35 % of the total processed potato crop is discarded as a waste during processing. These wastes ferment rapidly and add to the pollution problem if not properly utilized.

All potato (*Solanum tuberosum*) products are good sources of energy for ruminants. Stanhope *et al.* (1980) reported that the digestible energy content of potato by-product was similar to that of barley when the by-product was included in cattle diets 30 to 60 % of dietary dry matter. Potatoes consist of 80% water and the water content of the peeling waste is usually more than 85%. Process waste should be mixed to other feed so that the dry matter content of the mixture is adequate.

Sprouting grains for human consumption has been used for centuries in Asian countries to improve food value (Resh, 2001). Sprouts technique can be used for green fodder production of many forage crops for production of fresh forage from oats, barley, corn, wheat and other grains (Rodriguez-Muela *et al.*, 2004).

Sprouts green fodder (SGF) produced is of a short growth period and does not require high-quality arable land, but only a small piece of land for production to take place (Mooney, 2005). Germination and sprouting activates enzymes change the starch, protein, and lipids of the grain into simpler forms, for example, starch changes to sugars. There are some arguments about the sprouting grains for convenience of green forage production in sprouting system to compensate the feed resources for animals (Rajendra *et al.*, 1998 and Tudor *et al.*, 2003). This technology may be especially important in the regions where forage production is limited (Mukhopad, 1994 and Bustos *et al.*, 2000). Generally, the seeds are allowed to germinate and grow for about one to two weeks when a forage mat made up of the germinated seeds, their interwoven white roots, and the green shoots is obtained (Cuddeford, 1989). The whole product is then fed to the animals and the empty space in the chamber is used to germinate a new set of seeds (Mukhopad, 1994). It can be concluded that the biological and

economical viability of production of sprouts technique will depend on sprouting systems, type and quality of the grain, particularly the germination rate, culturing conditions, management, and the local conditions that merits further investigation.

The objective of the present work is to study the effect of sprouts technique (planting) white corn seeds on mixture in different proportions from potatoes peel waste, (DPL) and date palm leaves, as media to produce green fodder in dried seasons to improve the palatability and nutritive value of green fodder that fed to goats and study their effects on digestibility, some rumen and blood parameters of goats.

## **MATERIALS AND MEHODS**

The present work was carried out at South Sinai Research Station (Ras Suder City) which belongs to the Desert Research Center. Dried date palm leaves were collected and chopped into 2-3 cm and wet potato peel waste (PPW) was obtained from chipsy for food industries CO. S.A.E., 6<sup>th</sup> October City. The waste was spread in thin layers on trays and left for sun drying and used as bedding media.

Production method for grains sprouts was tray method as described by Mohammadi *et al.* (2007) using about 10 cm thick layer of chopped dried date palm leaves (DPL) and potatoes peel waste (PPW) as a sprouting media. Cereal grains of local white corn (*Zea Mays L.*) were cleaned from debris and other foreign materials. Then the cleaned seeds were surface sterilized by soaking for 30 minutes in a 2% sodium hypochlorite solution to prevent the formation of mould. Planting trays and the growing cabinet also were cleaned and disinfected. The seeds were washed well from residues of bleach and re-soaked in tap water overnight (about 12 hours) before sowing. At the end of soaking period, soaked seeds were spread evenly on the top of date palm leaves (DPL) and potatoes peel waste (PPW) media. Germination period on the media surface lasted about 15 days to get shoot sprouts, shoot length was 20-23 cm, seeding rate used in this experiment was about 10% density of roughage (DPL and PPW), planting trays were irrigated by tap water once a day early in the morning to provide enough water to keep the seeds/ seedlings moist.

The trays contained green fodders of tested media were removed from the chamber and the fresh fodder batches were representative samples (250g each), in four replication, were oven-dried at 60 °C, ground to pass a 1-mm mesh screen sieve and stored for chemical analysis.

Twenty five desert male goats averaged eighteen months old with 22.76 ±1.29 kg live body weight) were divided randomly into five equal groups fed the following rations:

- R1: alfalfa (*Medicago sativa*) hay (control).
- R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL).
- R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL).
- R4: 25% potatoes peel waste (PPW) +75% date palm leaves (DPL).

R5: 100% date palm leaves (DPL).

Goats were used in a feeding trial lasted for forty five days. The metabolism trials were conducted after the feeding trial to get the most nutritious sprouts green fodder (SGF) with concentrate feed mixture (CFM). Each goat group was housed in individual shaded pens and offered the dietary sprouts green fodder (SGF) in separate feeders daily plus the recommended amount of concentrate feed mixture (CFM) to cover 20 % of their maintenance requirements according to of Kearl, (1982). concentrate feed mixture contained: 94.28 DM, 91.07 OM, 14.13 CP, 7.01 CF, 2.01 EE, 8.93 ash, 67.88 NFE, 17.39 GE, MJ/kg DM, 62.34 NDF, 9.57 ADF, 52.77 Hemicellulose, 37.66 C.CHO, 0.150 Sodium and 0.170 Potassium (as % DM basis). Drinking water was available twice daily for animals. Combined water was calculated as Fresh-Dry diet ml/kgBW. Metabolic water was calculated from TDN intake a yield of 0.6 gm water per gm TDN (Farid *et al.*, 1986).

At the end of the experimental feeding, four animals from each group were randomly selected for the metabolism trial, fifteen day adaptation period followed by 5 days collection period. During the collection period, fecal and urine samples were collected daily (10% by weight of daily samples). Daily water intake was calculated and recorded. At the end of collection period of the metabolism trial, rumen, liquor was sampled by stomach tube at 0, 3, 6 hours after feeding. Blood samples were taken from jugular vein after feeding.

Chemical composition of feeds residues, faeces and urine were determined according to the A.O.A.C. (1997). Fiber fraction (NDF and ADF) were determined according to Goering and Van Soest (1970). Rumen total volatile fatty acids (TVFA's) were tested (Warner, 1964) and ammonia nitrogen values were also evaluated (A.O.A.C. 1997). Sodium (Na) and potassium (K) were determined in feed, refusal, feces, urine and drinking water by using the standard flame photometry (Jackson, 1958). Blood serum samples were assayed for total protein (Armstrong and Carr 1964), albumin (Doumas *et al* 1971). Globulin was obtained by subtracting the albumin values from the total proteins values. Serum creatinine (Henry1965) and urea (Patton and Crouch, 1977) were also determined all blood serum analysis was measured using Jenway spectrophotometer (UK) and using kits purchased from Human Company (Germany).

The data were subjected to the statistical analysis system according to SAS (1998). Differences in mean values between groups were compared by Duncan's multiple Range tests (1955).

## **RESULTS AND DISCUSSION**

### **Laboratory study:**

Data of Table 1 showed that chemical compositions of dried potatoes peel waste (PPW) were 13.89% CP, 11.83% CF, 1.21% EE and 16.50 GE MJ/kg DM. These results were in agreement with those, obtained by Duynisveld and Charmley, (2002) and Boyles (2006), they recorded that CP in potato waste ranged between 4% to 14.3% and CF ranged between 1.6%

to 17.5%. Chemical compositions of dried date palm leaves (DPL) were 3.76% CP, 33.15% CF, 2.0% EE and 15.70 GE MJ/kg DM, which are in the same trend with those found by Chehma and Longo (2001), and Medjekal *et al.* (2011), they recorded that CP in dried date palm leaves (DPL) ranged between 3.9% to 5.6%, CF ranged between 30.9% to 33.0%, 2.00% EE and 16.9 GE MJ/kg DM.

Results in Table 1 revealed that sprouting corn seeds on potatoes peel waste as a media had increased CP content from 13.89 to 15.17%, EE from 1.21 to 2.39%, C.CHO from 43.09 to 45.29 and ash from 13.07 to 22.93%, and decreased OM content from 86.93 to 77.02%, CF from 11.83 to 10.04%, NDF from 56.91 to 54.71%, and ADF from 28.15 to 20.37% as compared with unsprouted PPW. On the other hand, sprouting corn seeds on date palm leaves as a media had improved CP content from 3.75 to 7.52%, EE from 2.20 to 2.22%, C.CHO from 18.50 to 31.17 and ash content from 13.50 to 17.75% while decreased OM content from 89.88 to 82.25 %, CF from 33.15 to 31.99%, NDF from 81.50 to 77.98%, and ADF from 59.80 to 46.81% as compared with none sprouted DPL. Researcher in many ways demonstrated that CP increased in sprouting technique; Morgan *et al.* (1992) reported that CP content was increased from 10.8 (at day 4) to 14.9 % (at day 8) in hydroponically barley fodder that were in accordance with our findings. Fazaeli *et al.* (2012) reported that CP content was increased from 14.32 (at day 6) to 20.04 % (at day 8) in hydroponically barley fodder.

**Table 1: Chemical composition and cell wall constituents of none sprouted and sprouted media (% on DM basis)**

Items	Treatments					
	None Sprouted			Sprouted		
	Cs	PPW	DPL	SCs	SPPW	SDPL
DM	88.51	91.60	92.68	96.83	91.38	91.52
OM	98.53	86.93	89.88	93.36	77.02	82.25
Ash	1.47	13.07	13.50	6.64	22.98	17.75
CP	8.95	13.89	3.76	9.67	15.17	7.52
CF	1.92	11.83	33.15	7.13	10.04	31.99
EE	4.32	1.21	2.0	2.96	2.39	2.22
NFE	83.34	60.0	47.59	73.55	49.42	40.52
NDF	8.83	56.91	81.50	36.70	54.71	77.98
ADF	2.15	28.15	59.80	12.16	20.37	46.81
Hemicellulose	6.68	28.76	21.70	24.54	34.34	22.02
C.CHO	91.17	43.09	18.50	63.3	45.29	31.17
GE MJ/kg DM	18.90	16.50	15.70	17.80	15.10	17.34
Sodium %	0.02	0.24	0.23	0.17	0.27	0.27
Potassium %	0.46	0.13	0.15	0.08	0.14	0.17
Calcium %	0.04	0.04	0.58	0.05	0.06	0.65
Phosphorus %	0.24	0.22	0.09	0.25	0.24	0.1

Cs: corn seed; (SCs): sprouted corn seed; (PPW): potatoes peel waste; (SPPW): sprouted potatoes peel waste; (DPL): date palm leaves; (SDPL): sprouted date palm leaves; DM: dry matter; OM: organic matter; CP: crude protein; CF: crude fiber; EE: ether extract; NFE: nitrogen free extract; NDF: natural detergent fiber; ADF: acid detergent fiber; C.CHO: converted carbohydrates = (100-NDF). GE: gross energy.

Also, Al-Ajmi *et al.* (2009) found about 14 % increase of CP in hydroponically barley green fodder. But, Snow *et al.* (2008) reported a higher

(16.13%) CP content, in hydroponically barley fodder and the CP contents could be affected by the cultivation conditions in hydroponic systems. Moreover, Lorenz (1980) stated that the sprouting of grains causes increased enzyme activity, a loss of total DM, an increase in total protein, a change in amino acid composition, a decrease in starch, increases in sugars, a slight increase in crude fat and crude fiber, and slightly higher amounts of certain vitamins and minerals. Most of the increases in nutrients are not true increases; they simply reflect the loss of DM, mainly in the form of carbohydrates, due to respiration during sprouting. As total carbohydrates decreases, the percentage of other nutrients increases.

**Chemical composition of the tested rations:**

The chemical composition of the different rations is shown in Table 2. There were wide variations between the chemical composition of the four sprouted mixtures fodder (R2, R3, R4 and R5) and alfalfa hay (R1). R2 contained the highest CP content (15.17%) compared with other rations. On the other hand, lowest values of OM, CF, NFE and GE were recorded by R2. It was clear that as the portions of date palm leaves (DPL) in the ration increase the CP, ash, sodium% and potassium% content decrease; however, CF and GE content increased. Fiber fractions in rations (R2, R3, R4 and R5) were increased by increasing the inclusion of DPL portion in the rations compared with R1. The improvement in sprouted mixtures may be attributed to increase the activity of sprouted corn seed hydrolytic enzymes which catabolized starch to soluble sugars for use in respiration and cell-wall synthesis during the germination and early stage of plant growing and lead to improvements in chemical composition of PPW and DPL. Similar results were obtained by Chavan and Kadam (1989).

**Table 2: Chemical analysis and cell wall constituents of the tested rations (on DM basis)**

Composition	Rations				
	R1	R2	R3	R4	R5
Dry matter	91.83	92.85	92.67	91.47	91.52
Organic matter	84.18	58.03	68.11	73.80	82.25
Crude protein	12.36	15.17	12.05	9.64	7.52
Crude fiber	23.55	15.13	18.53	18.36	31.99
Ether extract	2.20	1.36	1.58	1.18	2.22
Ash	15.83	41.97	31.89	26.20	17.75
NFE	46.06	26.37	35.95	44.62	40.52
NDF	45.85	57.13	55.96	64.04	77.98
ADF	30.75	38.09	37.34	42.77	46.81
Hemicellulose	15.11	19.04	18.62	21.28	22.02
C.CHO	54.15	42.87	44.04	35.96	31.17
GE MJ/kg DM	16.36	11.55	13.29	14.47	17.34
Sodium %	0.43	0.263	0.230	0.210	0.168
Potassium %	0.605	0.213	0.202	0.184	0.150

Gross energy: MJ/kg DM = (CP \* 0.0226 + EE \* 0.0407 + CF \* 0.0192 + NFE \* 0.0177) (MAFF, 1975), NFE: nitrogen free extract, NDF: natural detergent fiber, ADF: acid detergent fiber, (C.CHO): converted carbohydrates calculated (NDF-100), GE: gross energy, R1: alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL).

By enhancing the time of sprouting, the higher organic matter, particularly starch consumed to support the metabolism and energy

requirement of the growing (Chavan and Kadam, 1989), therefore resulted in a lower OM and higher ash in sprouted grain. According to Kent-Jones and Amos (1967), after 6 days of growing, starch accounted for 53-67% of the dry weight of barley seed, so any decrease in the amount of starch would cause a corresponding decrease in OM, NFE and DM as well. In addition, the increase in EE could be due to the production of chlorophyll associated with plant growth (Mayer and Poljakoff-Mayber 1975).

#### **Feed intake and digestion coefficient**

Feed intake, digestion coefficients and nutritive values are presented in Table 3. Goats fed on alfalfa hay (R1) recorded the highest DMI. The results are also in conformity with Fazaeli *et al.* (2011), who reported that the animals that had received the control diet (barley green) had higher ( $P \leq 0.05$ ) dry matter intake than those fed sprouted barley green fodder. Differences in DMI between treatments (R2, R3, R4 and R5) were not significant.

It is clearly indicated that sprouting corn seeds on date palm leaves fed animals (R5) recorded the highest ( $P \leq 0.05$ ) digestibility coefficients of DM, OM, CF, EE, NDF and C.CHO with lowest value of CP digestibility coefficient. Highest digestibility coefficients of CP was recorded by animals fed R2 (81.72%) with no differences between R1, R2 and R3. This may be attributed to fresh grains sprouts have been reported to have highly soluble protein and amino acids in response to the enzymatic transformations during early plant growth (Chung *et al.*, 1989 and Dikshit and Ghadle, 2003). Sprouting corn seeds on our four studied mixtures had the highest ( $P \leq 0.05$ ) values in digestibility coefficients of EE and C.CHO compared with animals fed R1. On the other hand, there were no significant differences among the five rations in their digestibility coefficients of ADF and hemicellulose. This may be attributed to increase in the bioactive catalysts which assist in the digestion and metabolism of feeds and the release of energy. Similar results were reported by Shipard (2005) who found that feeding sprouted grains provided animals with living feed which has a rich supply of enzymes which results in all nutritional components being highly digestible and extremely nutritious.

Generally, digestibility coefficients of all nutrients were significantly ( $P \leq 0.05$ ) higher in sprouted corn seeds on our four studied mixtures. Similar trends were observed by Fayed (2011) who found that the digestibility coefficients of all nutrients for sprouted barley on rice straw and Tamarix were higher than that of untreated.

When the nutritive values expressed as TDN g/kg B.W and DCP g/kg B.W or DCP%, a significant differences ( $P \leq 0.05$ ) was detected among groups. It was higher in animals fed R1 and R5 followed by R4, R3 and the lowest R2.

Highest DCP g/kg B.W (5.31) and DCP% (11.89) were recorded by R2 compared with other studied rations. R3 and R1 were considered as fair values of DCP% (being 10.42 and 10.09%, respectively). On the other hand, lowest values were recorded by R5; these results may be attributed to low CP digestibility coefficients of animals fed R5. Similar results are in the same trend with those found by (Fayed, 2011 and Helal, 2012) they recorded that

nutritive values are improved when sprouted barley on dried *Acacia saligna*, *Tamarix mannifera* or rice straw as a media were higher than those for untreated roughages.

**Table 3: Average daily feed intake, digestion coefficient and nutritive value of goats fed the sprouted fodder.**

Items	Sprouted fodder					± SE
	R1	R2	R3	R4	R5	
No. of animals	4	4	4	4	4	
Live body weight	22.83	22.16	22.76	22.16	22.66	1.22
Dry matter intake g/ kg BW						
Concentrate feed Mixture	7.19 <sup>a</sup>	6.38 <sup>b</sup>	6.34 <sup>b</sup>	6.34 <sup>b</sup>	6.35 <sup>b</sup>	0.09
Sprouted mixture fodder	24.00	23.37	21.97	22.15	23.64	3.38
Total feed intake	31.19	29.99	28.32	28.50	29.75	3.43
Digestion coefficients %						
DM	73.69 <sup>b</sup>	75.30 <sup>ab</sup>	76.67 <sup>ab</sup>	76.89 <sup>ab</sup>	77.48 <sup>a</sup>	1.07
OM	75.94 <sup>b</sup>	72.57 <sup>c</sup>	76.19 <sup>b</sup>	74.91 <sup>bc</sup>	79.38 <sup>a</sup>	0.83
CP	81.63 <sup>a</sup>	81.72 <sup>a</sup>	79.53 <sup>ab</sup>	74.78 <sup>bc</sup>	72.73 <sup>c</sup>	1.53
CF	64.32 <sup>d</sup>	68.55 <sup>c</sup>	73.14 <sup>b</sup>	74.09 <sup>b</sup>	82.86 <sup>a</sup>	0.95
EE	45.48 <sup>b</sup>	85.79 <sup>a</sup>	84.76 <sup>a</sup>	80.11 <sup>a</sup>	85.00 <sup>a</sup>	1.99
NFE	81.80 <sup>a</sup>	70.39 <sup>c</sup>	76.13 <sup>b</sup>	75.62 <sup>b</sup>	77.91 <sup>b</sup>	0.98
NDF	70.03 <sup>b</sup>	71.31 <sup>b</sup>	72.40 <sup>b</sup>	74.02 <sup>b</sup>	78.61 <sup>a</sup>	1.31
ADF	72.71	74.96	76.37	76.48	75.14	1.86
Hemicellulose	64.61	63.57	64.85	69.39	78.38	2.30
C.CHO	76.78 <sup>b</sup>	82.49 <sup>a</sup>	82.68 <sup>a</sup>	79.23 <sup>ab</sup>	79.14 <sup>ab</sup>	1.57
Nutritive values						
Total digestible nutrient intake						
g/kg BW	37.01 <sup>a</sup>	22.00 <sup>b</sup>	24.95 <sup>b</sup>	27.15 <sup>b</sup>	29.99 <sup>ab</sup>	2.63
% of intake	65.17 <sup>ab</sup>	49.27 <sup>c</sup>	57.84 <sup>b</sup>	59.68 <sup>b</sup>	68.95 <sup>a</sup>	2.61
Digestible crude protein intake						
g/kg BW	5.19 <sup>a</sup>	5.31 <sup>a</sup>	4.55 <sup>ab</sup>	3.52 <sup>ab</sup>	2.77 <sup>b</sup>	0.63
% of intake	10.09 <sup>b</sup>	11.89 <sup>a</sup>	10.42 <sup>b</sup>	7.69 <sup>c</sup>	6.30 <sup>d</sup>	0.41

R1: alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL). a, b, c :means with different superscripts in the same row differ significantly ( $p \leq 0.05$ ), otherwise no differences were detected.

#### Nitrogen utilization and minerals balance:

Data of N-balance recorded for the five experimental rations are reported in Table 4. Nitrogen utilization (g/head/day) was affected significantly ( $P \leq 0.05$ ) by sprouting corn seeds on the four studied mixtures.

Nitrogen intake (NI) was significantly ( $P \leq 0.05$ ) higher in R1 (28.16) followed by R2 (22.93) while the lowest was recorded for R5 (13.60). The higher nitrogen intake may due to high content of crude protein in alfalfa R1 and sprouted mixture R2 (Table, 2). Goats fed R1 and R2 had highest ( $P \leq 0.05$ ) fecal and urinary nitrogen compared with other groups. While animals fed R2 and R3 had significant ( $P \leq 0.05$ ) higher amounts of nitrogen retention compared with other groups, while not significantly different between the treatments in nitrogen retention as a percent of total nitrogen intake (NR% of NI). This finding may be related to higher improvement in CP intake and its digestibility in sprouted mixtures compared with other experimental forages. These results are in similar trend with those found by (Fayed 2011 and Helal 2012).



Data on Na and K utilization revealed that Na intake, excretion and balance (g/kg BW) were varied significantly ( $P \leq 0.05$ ) among the experimental groups. The highest ( $P \leq 0.05$ ) values of Na and K intake and excretion were for R1. However, differences between the sprouted mixtures R2, R3, R4 and R5 were not significant. After sprouting and the depletion of nutrients from original seeds, roots plants that absorb nutrients from the media for the continued growth and life, which leads to reduced organic matter of the media with, increase the mineral, Also Morgan *et al.* (1992) found that ash content of sprouts increased from 2.1 in original seed (barley) to 5.3 at 8 day with increasing trace minerals.

**Table 4: Nitrogen utilization and minerals balance for goats fed the sprouted fodder.**

Items	Sprouted fodder					± SE
	R1	R2	R3	R4	R5	
Nitrogen utilization (g/head/day)						
Nitrogen intake (NI)	28.16 <sup>a</sup>	22.93 <sup>ab</sup>	18.59 <sup>bc</sup>	15.47 <sup>c</sup>	13.60 <sup>c</sup>	2.18
Fecal nitrogen (FN)	5.01 <sup>a</sup>	4.33 <sup>ab</sup>	3.81 <sup>ab</sup>	3.92 <sup>ab</sup>	3.70 <sup>b</sup>	0.37
urinary nitrogen (UN)	21.16 <sup>a</sup>	12.60 <sup>b</sup>	9.40 <sup>b</sup>	9.77 <sup>b</sup>	8.10 <sup>b</sup>	2.07
Total nitrogen excretion (TNE)	26.18 <sup>a</sup>	16.93 <sup>b</sup>	13.22 <sup>b</sup>	13.69 <sup>b</sup>	11.80 <sup>b</sup>	2.27
Nitrogen retention (NR)	3.36 <sup>ab</sup>	5.99 <sup>a</sup>	5.37 <sup>a</sup>	1.78 <sup>b</sup>	1.79 <sup>b</sup>	0.88
NR % of nitrogen intake	14.90	26.34	28.53	11.52	13.26	2.66
Fecal N% of nitrogen intake	18.36 <sup>c</sup>	18.88 <sup>c</sup>	20.46 <sup>bc</sup>	25.21 <sup>ab</sup>	27.27 <sup>a</sup>	1.57
Urinary N% of nitrogen intake	79.58 <sup>a</sup>	54.77 <sup>b</sup>	58.53 <sup>b</sup>	63.26 <sup>b</sup>	59.47 <sup>b</sup>	2.86
Digested nitrogen (DN)	23.15 <sup>a</sup>	18.59 <sup>ab</sup>	14.78 <sup>bc</sup>	11.55 <sup>c</sup>	9.89 <sup>c</sup>	1.94
DN % of nitrogen intake	81.63 <sup>a</sup>	81.12 <sup>a</sup>	79.53 <sup>ab</sup>	74.78 <sup>bc</sup>	72.73 <sup>c</sup>	1.57
Minerals Balance (g/kg BW)						
Sodium						
Sodium Intake	0.256 <sup>a</sup>	0.103 <sup>b</sup>	0.093 <sup>b</sup>	0.090 <sup>b</sup>	0.076 <sup>b</sup>	0.009
Feces Sodium excretion	0.023	0.013	0.013	0.016	0.013	0.003
Urine Sodium excretion	0.226 <sup>a</sup>	0.060 <sup>b</sup>	0.056 <sup>b</sup>	0.053 <sup>b</sup>	0.043 <sup>b</sup>	0.005
Total Sodium excretion	0.243 <sup>a</sup>	0.073 <sup>b</sup>	0.073 <sup>b</sup>	0.073 <sup>b</sup>	0.060 <sup>b</sup>	0.006
Sodium Balance	0.013	0.030	0.023	0.016	0.013	0.009
Potassium						
Potassium Intake	0.356 <sup>a</sup>	0.090 <sup>b</sup>	0.086 <sup>b</sup>	0.080 <sup>b</sup>	0.066 <sup>b</sup>	0.009
Feces Potassium excretion	0.020 <sup>a</sup>	0.010 <sup>b</sup>	0.010 <sup>b</sup>	0.013 <sup>b</sup>	0.010 <sup>b</sup>	0.001
Urine Potassium excretion	0.316 <sup>a</sup>	0.033 <sup>b</sup>	0.040 <sup>b</sup>	0.046 <sup>b</sup>	0.033 <sup>b</sup>	0.012
Total Potassium excretion	0.333 <sup>a</sup>	0.040 <sup>b</sup>	0.050 <sup>b</sup>	0.056 <sup>b</sup>	0.040 <sup>b</sup>	0.014
Potassium Balance	0.023	0.043	0.036	0.023	0.026	0.011

R1: alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL) a, b, c :means with different superscripts in the same row differ significantly ( $p \leq 0.05$ ), otherwise no differences were detected.

**Water utilization:**

Data of Table 5 showed that water intake (in terms of drinking, combined and metabolic water) were varied ( $P \leq 0.05$ ) significantly among animal groups. Water intakes was ( $P \leq 0.05$ ) higher in goats fed R1 compared with the four sprouted groups; however, goats in R2, R3, R4 and R5 tended to consume comparable amounts of water without significant differences. The highest amount of total water consumption was recorded (193.02 ml/kg/BW) for goats fed R1 compared with other groups. May be due to increasing of dry

matter intake (Table 3) and high content of sodium and potassium% (Table 2) in alfalfa fed to goats in R1. While there were no significant differences in total consumption of water among sprouted groups R2, R3, R4 and R5. On the other hand, goats fed R1 had highest significant total water excreted (106.68). These findings are in agreement with Eid (2003) and Allam *et al.* (2006) on animals fed similar dietary rations. They reported that feeding animals salt tolerant fodders of high ash content led to push animals to increase excretion of urine. Water balance was higher ( $P \leq 0.05$ ) in R1 with no differences among the four sprouted groups which mainly attributed to the pattern of water consumption and total water intake (Eid, 2003 and Allam *et al.*, 2006).

**Table 5: Water balance (ml/kg/BW) of goats fed the sprouted fodders**

Item	Sprouted fodder					±SE
	R1	R2	R3	R4	R5	
Drinking water	114.84 <sup>a</sup>	22.38 <sup>b</sup>	21.70 <sup>b</sup>	26.26 <sup>b</sup>	23.91 <sup>b</sup>	7.57
Combined water	54.94 <sup>a</sup>	9.79 <sup>b</sup>	4.77 <sup>b</sup>	7.39 <sup>bc</sup>	4.82	1.23
Metabolic water	23.23 <sup>a</sup>	13.20 <sup>b</sup>	14.97 <sup>b</sup>	16.29 <sup>b</sup>	17.99 <sup>b</sup>	1.48
Total water intake	193.02 <sup>a</sup>	45.38 <sup>b</sup>	41.44 <sup>b</sup>	49.95 <sup>b</sup>	46.73 <sup>b</sup>	9.08
Fecal water	20.74 <sup>a</sup>	3.08 <sup>b</sup>	2.23 <sup>b</sup>	2.43 <sup>b</sup>	1.57 <sup>b</sup>	0.74
% of Intake	18.99 <sup>a</sup>	14.63 <sup>ab</sup>	10.70 <sup>ab</sup>	9.19 <sup>ab</sup>	6.41 <sup>b</sup>	3.14
Urinary water	85.94 <sup>a</sup>	18.06 <sup>b</sup>	17.63 <sup>b</sup>	20.25 <sup>b</sup>	17.36 <sup>b</sup>	4.72
% of Intake	75.67	81.68	80.60	78.92	71.25	6.66
Total water excreted	106.68 <sup>a</sup>	21.14 <sup>b</sup>	19.86 <sup>b</sup>	22.69 <sup>b</sup>	18.93 <sup>b</sup>	4.66
% of Intake	94.66	96.31	91.30	88.12	77.66	8.44
Water balance	86.33 <sup>a</sup>	24.25 <sup>b</sup>	21.58 <sup>b</sup>	27.93 <sup>b</sup>	27.79 <sup>b</sup>	5.10
% of Intake	76.21 <sup>b</sup>	105.69 <sup>ab</sup>	99.70 <sup>ab</sup>	102.42 <sup>ab</sup>	119.25 <sup>a</sup>	10.57

R1: Alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL). a, b, c :Means with different superscripts in the same row differ significantly ( $P \leq 0.05$ ), otherwise no differences were detected.

#### Rumen parameters:

Data of rumen total volatile fatty acids (TVFA,s) and ammonia-nitrogen are presented in Table 6. Rumen total volatile fatty acids (TVFA,s) revealed that sprouted corn grains increased TVFA,s concentrations in the rumen, which increased after feeding and reaches its peak after 3 hr. post feeding. There was a significant ( $P \leq 0.05$ ) increase in overall total volatile fatty acids (TVFA,s) concentrations; where animals in R4 showed the greatest values being (10.20 meq/100ml) followed by those in R1 (9.50), R3 (9.09), R5 (8.83) and R2 (8.79). It might be a reflection to rich energy and organic matter of fodder fed to small ruminants that provided higher concentrations of rumen metabolites which naturally improved rumen function and digestibility (Bonsi *et al.* 1995).

The increase in TVFA,s concentration with sprouted barley may be due to that sprouts provide a good supply of vitamins, enzymes which serve as bioactive catalysts to assist in metabolism of feed and the release of energy (Shipard ,2005, Fayed, 2011 and Helal, 2012).

It was clear that goats in R2 recorded the highest significant overall ammonia-nitrogen value (34.77 mg/100ml) compared to the other

experimental groups. This is may be due to high content of CP and CP intake in R2 (15.17%, Table 2) fed to animals in this group (Norton, 2003). Other researchers reported an increase in rumen ammonia N with increase in CP supplementation (Bohnert *et al.*, 2002; and Salisbury *et al.*, 2004).

**Table (6): Ammonia-nitrogen and total volatile fatty acids of goats fed the experimental fodder**

Criteria	Time	Sprouted fodder					overall mean
		R1	R2	R3	R4	R5	
*TVFA,S	0	6.22±0.70 <sup>ab</sup>	4.44±0.70 <sup>b</sup>	5.08±0.66 <sup>ab</sup>	6.88±0.70 <sup>a</sup>	6.99±0.41 <sup>a</sup>	5.92 ±0.43 <sup>c</sup>
	3	11.77± 1.07	11.51± 1.07	11.80± 1.07	12.55± 1.07	13.29± 1.07	12.18±0.43 <sup>a</sup>
	6	10.52±1.03	10.41±1.03	10.40±1.03	11.16±1.03	12.08±1.03	9.74±0.43 <sup>b</sup>
overall m.		9.50±0.56 <sup>b</sup>	8.79±0.56 <sup>b</sup>	9.09±0.56 <sup>b</sup>	10.20±0.56 <sup>a</sup>	8.83±0.56 <sup>b</sup>	
*NH3-N	0	22.13± 1.08 <sup>b</sup>	29.75± 1.08 <sup>a</sup>	22.76± 1.07 <sup>b</sup>	22.63± 0.89 <sup>b</sup>	20.19± 0.72 <sup>b</sup>	23.49±0.34 <sup>c</sup>
	3	39.49± 0.59 <sup>a</sup>	39.71± 0.59 <sup>a</sup>	37.82± 0.59 <sup>ab</sup>	36.88± 0.59 <sup>b</sup>	27.96± 0.59 <sup>c</sup>	36.37±0.34 <sup>a</sup>
	6	34.48± 0.66 <sup>a</sup>	34.86± 0.66 <sup>a</sup>	33.73± 0.66 <sup>ab</sup>	31.70± 0.66 <sup>b</sup>	22.23± 0.66 <sup>c</sup>	31.40±0.34 <sup>b</sup>
overall m.		32.03± 0.45 <sup>b</sup>	34.77± 0.45 <sup>a</sup>	31.44± 0.45 <sup>bc</sup>	30.40± 0.45 <sup>c</sup>	23.46± 0.45 <sup>d</sup>	

**TVFA,s: Total volatile acids meq/100ml: (NH3-N); Ammonia nitrogen mg/100ml.**

**R1: alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL) a, b, c :means with different superscripts in the same row differ significantly (P≤0.05), otherwise no differences were detected.**

**Blood parameters:**

Data of serum constituents of the studied goats as affected by sprouting corn seeds on the studied mixtures are given in Table 7. Serum urea-N did not affect significantly. Creatinine (mg/dl), total protein (g/dl), albumin (g/dl), globulin (g/dl), ALT (U/L) and AST (U/L) were significantly elevated (P≤0.05) by treatments. Goats fed R1 increased (P≤0.05) serum total proteins, albumin, globulin, ALT and AST. The high level of globulin of sprouted barely treatments may indicate good developed immunity status (Ibrahim *et al.*, 2001). This is in accordance with those reported by Kumar *et al.* (1980) who found a positive correlation between dietary protein and plasma protein concentration. Also, means of serum creatinin increased significantly (P≤0.05) with R3. This was probably due to the high level of CP content in R3. The lowest value of serum urea and creatinin were recorded by R5. These results are in harmony with those reported by Fayed (2011). Additionally, Elisabetta *et al.* (2009) induced that integration with hydroponically germinating oat in partial substitution of the complete feed does not modify biochemical and hematological parameters and seems to produce an improvement in animal.

Serum minerals revealed that goats fed R1 had highest (P≤0.05) values of calcium and potassium (mg/dl) being 9.93 and 4.52; while, R1 and R2 had fair values of sodium and phosphorus (mg/dl) as compared with other groups (Table7).

**Table 7: Blood metabolites changes of sheep fed the experimental diet**

Item	Rations					±SE
	R1	R2	R3	R4	R5	
Urea (mg/dl)	37.25	37.55	37.00	36.23	35.88	0.66
Creatinine (mg/dl)	1.54 <sup>b</sup>	1.53 <sup>b</sup>	1.55 <sup>a</sup>	1.41 <sup>b</sup>	1.34 <sup>b</sup>	0.03
Total protein (g/dl)	6.63 <sup>a</sup>	6.06 <sup>b</sup>	5.93 <sup>bc</sup>	5.84 <sup>c</sup>	5.68 <sup>d</sup>	0.04
Albumin (g/dl)	2.71 <sup>a</sup>	2.50 <sup>b</sup>	2.46 <sup>bc</sup>	2.39 <sup>cd</sup>	2.36 <sup>d</sup>	0.02
Globulin (g/dl)	4.02 <sup>a</sup>	3.82 <sup>b</sup>	3.56 <sup>c</sup>	3.46 <sup>dc</sup>	3.31 <sup>d</sup>	0.05
ALT (U/L)	13.25 <sup>a</sup>	10.20 <sup>b</sup>	9.73 <sup>b</sup>	8.74 <sup>c</sup>	7.36 <sup>d</sup>	0.28
AST (U/L)	20.25 <sup>a</sup>	18.33 <sup>b</sup>	21.12 <sup>a</sup>	21.36 <sup>a</sup>	21.14 <sup>a</sup>	0.38
Calcium (mg/dl)	9.93 <sup>a</sup>	9.23 <sup>b</sup>	8.36 <sup>c</sup>	7.87 <sup>d</sup>	7.83 <sup>d</sup>	0.10
Phosphorus (mg/dl)	5.85 <sup>ab</sup>	6.01 <sup>a</sup>	5.80 <sup>b</sup>	5.54 <sup>c</sup>	5.42 <sup>c</sup>	0.05
Sodium (mg/dl)	150.83 <sup>a</sup>	147.33 <sup>a</sup>	137.66 <sup>b</sup>	133.00 <sup>bc</sup>	130.00 <sup>c</sup>	2.02
Potassium (mg/dl)	4.52 <sup>a</sup>	4.00 <sup>b</sup>	4.06 <sup>b</sup>	4.08 <sup>b</sup>	4.07 <sup>b</sup>	0.06

R1: alfalfa (control), R2: 75% potatoes peel waste (PPW) + 25% date palm leaves (DPL), R3: 50% potatoes peel waste (PPW) + 50% date palm leaves (DPL), R4: 25% potatoes peel waste (PPW) + 75% date palm leaves (DPL) R5: 100% date palm leaves (DPL). a, b, c, d means with different superscripts in the same row differ significantly (P≤0.05), otherwise no differences were detected.

## CONCLUSION

It could be concluded that we can produce green fodder especially in dry season by sprouting white corn seeds on roughages like date palm leaves (*Phoenix dactylifera* L.) and potatoes peels waste (*Solanum tuberosum*) as a media mixture (with percent 50% PPW and 50% DPL) high nutritive value for the animals and environment-friendly as well as reduce the cost of feeding by utilizing dried desert and agriculture by-products with simple methodology using crop sprouts and employ to produce forage feed instead of causing pollution.

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## انبات حبوب الذرة الشامية على مخاليط سعف النخيل و قشور البطاطس الجافة وتأثير ذلك على اداء الماعز الصحراوي تحت ظروف الجفاف في سيناء

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قسم تغذية الحيوان والدواجن، مركز بحوث الصحراء، المطرية، القاهرة، مصر

هدف الدراسة الحالية الى دراسة تأثير انبات حبوب الذرة الشامية على مخاليط من سعف النخيل و قشور البطاطس الجافة على اداء الماعز الصحراوي. استخدم عدد ٢٥ ذكر ماعز صحراوي (متوسط وزن البداية ٢٢.٧٦ ± ١.٢٩ كجم) عمر حوالي ١٨ شهرا، حيث تم تقسيمها الى خمس مجموعات (٥ حيوانات للمجموعة). تم تغذية الخمس مجموعات التجريبية على واحد من الاعلاف الخشنة التالية حتى الشبع وهي: المجموعة الاولى دريس برسيم حجازي (مجموعه ضابطة)، المجموعة الثانية مخلوط من ٧٥% مسحوق قشور البطاطس و ٢٥% مسحوق سعف النخيل بعد تنبيت حبوب الذرة عليها، المجموعة الثالثة مخلوط من ٥٠% مسحوق قشور البطاطس و ٥٠% مسحوق سعف النخيل بعد تنبيت حبوب الذرة عليها، المجموعة الرابعة مخلوط من ٢٥% مسحوق قشور البطاطس و ٧٥% مسحوق سعف النخيل بعد تنبيت حبوب الذرة عليها، المجموعة الخامسة عبارة عن مخلوط من ١٠٠% مسحوق سعف النخيل بعد تنبيت حبوب الذرة وبناء عليه:-

تم اجراء تجربة تغذية علي الماعز استمرت ٤٥ يوما، تلتها تجربة هضم لتقدير معاملات الهضم للاعلاف التجريبية الخشنة وكانت اهم النتائج:-

ادت عملية انبات حبوب الذرة علي البيئات المختلفة الى زيادة محتواها من البروتين الخام، مستخلص الاثير، الكربوهيدرات المتحولة والرماد مع انخفاض محتواها من المادة العضوية، الالياف الخام و مكونات الالياف مقارنة بالبيئات التي لم تتم عليها عملية الانبات.

أدى انبات حبوب الذرة على مخاليط البيئات المختلفة الى تحسن معنوي في معاملات هضم كل من المادة الجافة، مستخلص الاثير، الكربوهيدرات المتحولة والمركبات الكلية المهضومة مقارنة بالمجموعة المغذاه على البرسيم الحجازي (المقارنة).

سجلت المجموعة الثالثة اقل قيم معنوية للمأكول الكلي واعلى معاملات هضم للمادة الجافة، البروتين الخام، مستخلص الاثير، الكربوهيدرات المتحولة و البروتين الخام المهضوم. كما سجلت المجموعة الثالثة اعلى قيم معنوية للنتروجين والنتروجين المأكول مقارنة بباقي المجموع التجريبية.

سجلت الماعز المغذاه على المخاليط المنبت عليها حبوب الذرة تحسنا لقيم ماء الشرب الكلية مع انخفاض افراس الماء من خلال البول. كما سجلت الماعز المغذاه على المخاليط المنبت عليها حبوب الذرة تحسنا لقيم ميزان الصوديوم والبوتاسيوم (جم / كجم وزن جسم) مقارنة بمجموعة الكنترول.

سجلت الماعز المغذاه على المخاليط المنبت عليها حبوب الذرة اعلى قيم معنوية للاحماض الدهنية الطيارة، تركيز امونيا الكرش، تركيزات البروتين الكلي، الالبومين، الجلوبيولين، اليوريا والكرياتينين في مقارنة بتلك المغذاه على البرسيم الحجازي (الكنترول). وبناء عليه يمكن الاستفادة من مسحوق سعف النخيل وقشور البطاطس الجافة كبنية (بنسبة ٥٠% : ٥٠%) لانتاج الاعلاف الخضراء عن طريق استغلال عملية انبات حبوب الذرة عليها دون حدوث اي آثار ضارة للماعز الصحراوي والمرباه تحت ظروف الجفاف في المناطق الصحراوية.

### قام بتحكيم البحث

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