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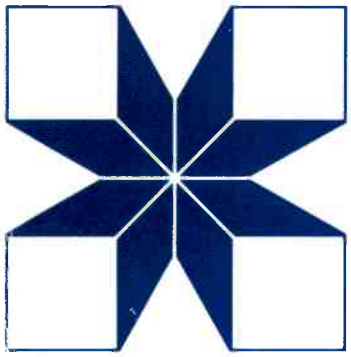

CANADA

SMALL RUMINANTS RESEARCH AND DEVELOPMENT IN THE NEAR EAST

PROCEEDINGS OF A WORKSHOP

HELD IN CAIRO, EGYPT,

2–4 NOVEMBER 1988

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La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d'être publiés plus tard dans une série de publications plus soignées. D'un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.

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SMALL RUMINANTS RESEARCH AND DEVELOPMENT IN THE NEAR EAST

**Proceedings of a workshop
held in Cairo, Egypt, 2-4 November 1988**

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FEEDSTUFFS SUPPLEMENTATION IN DETERIORATIVE RANGELANDS : EFFECT ON PERFORMANCE OF SMALL RUMINANTS IN ARID AND SEMI-ARID REGIONS.

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ABSTRACT

Rangelands of arid and semi-arid regions are deteriorating in productivity because of reasons other than natural drought. Increasing livestock number, improper range management and unawareness of range-users about the benefits of long-term range improvement plans, are main reasons for loosing range productivity.

The nutritive value of utilizable fodders in deteriorative rangelands decrease as a result of water-lack, extremely high temperature and continuous grazing and defoliation. Consequently, crude protein decrease and non-protein-nitrogen and crude fiber increase.

Feedstuffs are used as supplements to the range in drought seasons, but the need is greater, for these supplements in physiological stressing factors; late pregnancy and lactation. Energy is the main nutrient needed in these supplements although ammonia-treated roughages are sometimes used.

Generally, a significant improve in performance of small ruminants occur as a result of feeding low or medium-energy level of supplement since dependance on grazing alone in deteriorative rangelands, can hardly satisfy the maintenance requirement of ewes and does. The improve in reproductive performance of ewes may increase by two-folds as a result of supplementation.

Applying common research findings to NW rangelands of Egypt, suggests to introduce supplementary feeds in times of physiological stress rather than in drought per se, even if the range situation is relatively in a better condition.

The practice of feedstuff supplementation if becomes a

habit to range users, may lead to a serious socio-economic problems.

INTRODUCTION

Rangelands are considered natural resources of arid and semi-arid regions. Their trees, shrubs, semi-shrubs and herbage not only provide feeds and shelter for grazing / browsing livestock, but they also have other useful uses as nutrient recycling and soil fertility; industrial and medicinal; ornamental and food for humans (Zaroug, 1985; Maldanado, Le Houérou, 1980).

Significant areas of rangeland regions are witnessing however, serious deterioration of its vegetation cover because of factors which include human errors and natural drought.

The aim of this communication was to review available research on productive performance of small ruminants (SR) grazing / browsing in deteriorative rangelands in arid and semi-arid regions. This review was intended to specify : reasons for rangelands damage, reasons for the need of feedstuff supplements and to integrate specific research findings on SR to the sheep production system in the NW rangelands of Egypt.

REVIEW

1. Ecological features pertinent to range pasture production and management

Arid and semi-arid areas are characterized by an annual rainy season which usually precipiates from 70 to less than 200 mm of rain. This volume of moisture meets the needs for growth of natural range plant species beside the growth of barley which is by experience, in some semi-arid areas, usually seeded just before the rain starts (e.g. NW rangeland of Egypt).

From the range plants production standpoint, there is an over-adequate supply of feed-nutrients for grazing and browsing ruminants during the rainy season. It is an acceptable fact now that, this supply may last for a month or more following the cessation of the rains but is then followed by a shortage or severe shortage of quality feeds during the rest of the year. From the literature, it is evident that on all-year-round basis, natural range pastures under such conditions can satisfy at least the maintenance requirements of small ruminants if their production system is extensive in nature with a stocking rate of about animal

unit per 3 ha (7 feddans) of range-land.

The above described situation is not always the common case in most arid and semi-arid areas because of one or both the coming reasons (Le Houerou, 1988; 1980; Draz, 1980):

First, the wide fluctuation which occur in precipitation within a season and among seasons particularly in the duration of the rainy season and the occurrence of what is termed by the "drought cycle".
Second, the poor management practices exercised by the range-users which results in increasing ruminants number and an over-grazed range-land situation.

Relatively, the poor management practices have greater constraints on range productivity since the users of the range in most areas, have not developed systems for controlled grazing, production of grazing rights and range reserves (Draz, 1983). In the literature, examples are found for describing the effect of poor management on natural range productivity. Draz (1983), reported that range deterioration, degradation of plant cover and low productivity are now common features of the arid and semi-arid range lands in many countries of the Near East. In Egypt, preliminary survey studies carried out by the MOA (Aboul-Naga et al., 1987) indicated a serious deterioration of the NW coastal range-lands. In that survey, the main reason for such deterioration was the improper range management practices.

Too many poorly managed animals over-graze the range pastures causing deterioration of vegetation, and closely defoliation; this practice cause reduced vigor, lessens seed production and eventually, plant death (Heady, 1975). Moreover, the observed desertification in semi-arid regions is due to overgrazing/browsing and the removal of firewoods which lead to exposing of the soil to water and wind erosion (Roberts, 1987). The introduction of improved pasture species to deteriorative rangelands could be a solution for increasing its pasture cover. This technique may increase carrying capacity by ten folds (Edye and Gillarad, 1985) but needs the addition of fertilizers. Unfortunately, the cost of such inputs in semi arid regions are so heavy to limit the use of this technique.

2. Effect of drought on nutritive value of range plants and their palatability

The literature was reviewed with regard the effect on the nutritive value of range plants of natural drought or

water-lack. There is a general agreement on the fact that the nutritive value of range plants whether annuals or perennials, decrease as a result of water shortage (Rae et al., 1963; Hassan et al., 1980 a). This decrease in nutritive value is due in great part, to a decrease in crude protein content joined with an increase in the fiber component (Vera, 1973); Hassan et al., 1980b; Benjamine et al., 1986; Van Soest, 1982). The increase in NPN as a result of water shortage (Wilson, 1966; 1977) could explain more the reduction in digestibility. Shrubs like Atriplex Spp. grown under the stress of water-lack, although contain as high as 20% crude protein (Wilson, 1977), yet more than 60% of that protein is in the form of NPN which result in lowering organic matter digestibility to as low as 40-45 % (Benjamin et al., 1986). Water stress and extremely high temperature are contributing factors to the low protein content of herbage at different stages of growth (Lyttleton, 1973).

The relationship between nutritive value and seasonal growth of range pasture can be best described in graph. 1 which summarize data reported by Abdel Aziz (1982) Hassan et al., (1980b) for a mixture of annuals and perennials growing in the NW arid zone of Egypt or in Southern Sinai.

Since the chemical make-up of the plant is directly related to its palatability (Malecheck and Provenza, 1983; GRM, 1982) and in particular to the presence of what is termed secondary plant metabolites, that range-plants become less palatable in drought situation, at least for a grazing ruminant like the sheep. The goat on the other hand, with its highly selective sense under different feeding / management systems in different climatic environmental conditions, (Devendra, 1981; Gall, 1981; Merrill and Taylor, 1981; Morand-Fehr, 1981) can easily modify its nutritional and physiological state to overcome the newly developed stress condition. The following data (GRM, 1982) show the relative palatability by sheep and goats of three arid-range-fodders and its relationship with chemical composition:

Fodder plant	Relative Palatability		Chemical analysis % DM			
	Goats	Sheep	N	P	K	ash
Acacia ehrenbergiana	++	+	2.3	.17	.61	7.8
Acacia tortilis	++	+	2.8	.14	.51	8.4
Atriplex nummularia	+	+	3.1	.13	.67	13.8

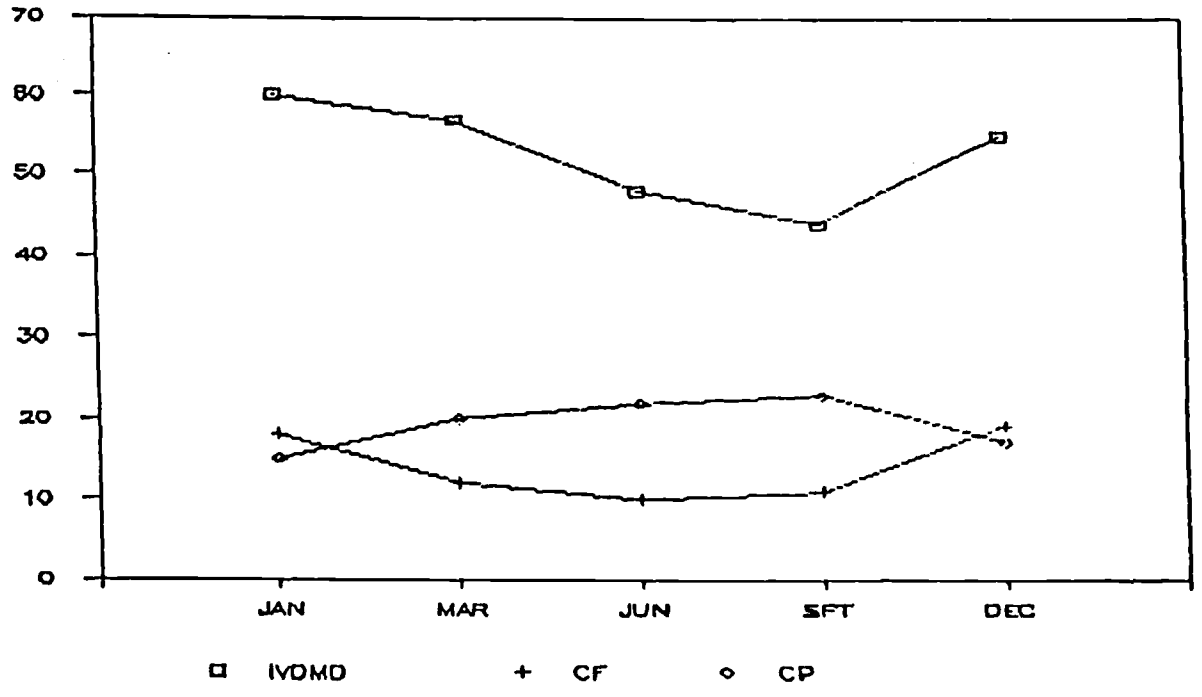

Figure 1. Effect of season on the nutritive value of range-fodders of semi-arid regions in Egypt.

Some herbaceous species which grow after rain in arid and semi arid regions are usually more palatable than other shrubs or semi-shrubs. Seligman et al., (1986) and Benjamine et al., (1986) reported palatability ranking of five fodders by sheep as: crucifera > Cassia sturtii > Atriplex; (A) canescens > A. nummularia > A. linearis > Acasia victoria.

3. Supplementary feedstuffs and its effect on ruminants grazing in arid and semi-arid areas; Why, How, When and How much

From the discussion presented above, it can be extracted that one important reason for the need of supplementary feedstuffs to range pasture, is in drought situations. Another more important reason for that need, arises when the animal is under internal physiological stress condition; late pregnancy and early lactation (El-Serafy, 1988). From a biological point of view, the need for more quality feed-nutrients is greater under the physiological stress than under climatic stress, since experimental evidences of adaptive mechanisms to combat heat and water deprivation has been reported (Farid, 1987). These adaptive mechanisms are: heat tolerance, fluctuation in body temperature, decreasing feed intake and long-term adaptation to protein deficiency.

When small ruminants are grazing on Atriplex nummularia as sole feed, they do not satisfy their production requirements of energy; sheep may not obtain even their maintenance energy requirements. The data of table 1 (Shehata et al., 1987) indicate an average loss and gain per weights of sheep and goats, respectively of 19.4 & 11.9 g.

Based on the energy requirements values for sheep (NRC, 1978) and goats (Devendra, 1967; Lindahl, 1968), the author calculated the annual TDN requirement by ewes and does at different weight categories and at different physiological status (table 2). The data indicate that the requirements at late pregnancy and lactation for ewes and does bearing only singles is about 2.4-2.5 times the maintenance energy need in maximum activity; such high requirements can not be met by grazing natural range plants alone since in this case the animals will desipate more energy in searching for food (GRM, 1982).

Supplementary feedstuffs are purchased in different forms depending on different factors as availability, price and location of the range. Main feedstuffs forms however, are either pellets or blocks for concentrate mixtures or bales for hay & straw.

TABLE 1

SR Performance trials :
I. Effect of grazing on productive performance*.

Item	Sheep		Goats	
	Rams	Ewes	Bucks	Does
No. of animals	4	39	4	39
Body weight, kg	43.9	30.8	25.9	21.6
Avg. MBS ($w^{.75}$, kg;A)	17.1	13.1	11.5	10.0
ADG OR Loss, g	-27.2	-13.8	-15.3	-12.9
" " % BW	.62	.115	.59	.60
DMI, g /A	28.9	55.7	38.9	71.5
% in vivo Digestibility	40.9		45.0	
DDMI. g / A	11.81	22.8	17.51	32.2
Water consumption: ml	3200	---	1486	---
% BW	.73	---	.57	---
ml/A	188	---	129	---
ml/gDMI	6.5	---	3.33	---
ml/gDDMI	15.1	---	7.38	---
No. of females, lambed		12		16
Lambing %		30.7		41.0
No. of lambs born alive		15		25
Lambs / lambing		1.25		1.56
No. of lambs weaned		12		19
% mortality : birth-weaning		20		24

In Egypt, the MOA (ARC, APRI) is recommending ammonia-treated rice straw as a summer feed supplements for feeding pregnant ewes and growing yearlings of the coastal NW range lands. Training of the bedouins on the ammoniation process is planned through the CALAR project (Aboul-Naga et al., 1987). The chemical analysis (in % DM) of that feedstuff supplement was as follows (Shehata et al., 1987) DM: 89, DM, CP, 9.5; CF, 35; Ash, 14: NFE, 395. The calculated nutritive value (by the author) was : TDN, 35 and DP, 5 %. A ton of the ammonia-treated straw costs between LE, 55 to 65 depending on location of the range.

In Sultanate of Oman, the MOA offered a mixed grass legume-hay (50% TDN and 6% DP) to livestock holders in the drought seasons from 1981 through 1985 (El-Serafy, 1988). In the severe drought season of 1984 however, a concentrate

II. Effect on productive performance of sheep and goats, of controlled grazing on Atriplex nummularia in NW arid region Egypt.

Item	Sheep	Goats
No. of animals ( )	7	8
Avg. Initial BW, kg	52.1	39.3
" Final BW, kg	51.4	39.7
Mean MBS ($kg^{.75}$), kg	19.4	15.7
ADG / Loss, g	-(19.4)	11.1
DMI :		
g/ d	1434	1210
g/ $w^{.75}$	73.9	77.1
Water consumption:		
ml/ d	3.94	2.55
ml/ $kg^{.75}$	204	163
ml/ g DMI	2.75	2.11

continued

III. Effect of supplements on productive performance

	Treatment	ADG g/d	No.of Ewe lambs	No.of Ewes lam.	Lamb. %	No. of lambs	Lambs/ lambing
S*	1. Shrubs & barley grain	90	24	6	25	8	1.33
S*	2. Wheat after maths&18% concentrate	120	26	10	38	14	1.40
S*	3. Pen-fed barrley grain, poultry lit. & straw	124	23	8	35	13	1.63
L*	4. Shrubs & wheat straw	000	25	11	44	16	1.45
L*	5. Barley after maths &	41	25	15	60	23	1.53
L*	6. Wheat after maths with legume residues & 12% concentrate mix.	91	69	32	46	38	1.19

* S & L = Small & Large sheep.
- All small sheep (T 1,2,3) grow to the aimed weight; 40 kg.
- Sheep grazing on shrubs were 3.5 kg less than the other treatment / group.
- All sheep suffered from a skin disease for 15 days before recovery.

TABLE 2

Energy and protein requirements of ewes and does during different levels of activity and physiological status*

Activity / stress		Requirement, g/a/d/w$^{.75}$			
		TDN		DP	
		ewe	doe	ewe	doe
	M_1	29.3	29.5	2.61	2.61
Maint-	M_2	32.2	36.9	2.87	3.20
enance	M_3	33.7	39.0	2.98	3.43
	P_1	35.2	35.9	2.87	3.25
Production	P_2	52.4	53.1	4.70	4.70
P_3		72.6	73.2	6.9	6.90

pelleted feed mixture (45% TDN and 7% DP) was sold in subsidized price, to livestock holders in addition to the hay. Some livestock holders in that year fed sheep and goats on dried sardines and dried palm-dates; a feeding practice common only for lactating cows.

The amount of feedstuff-supplement to grazing / browsing ruminants, has a determinatal effect on their productive and reproductive performance and on the amount of range-plants consumed. Supplemental barley to grazing sheep and goats in experiments conducted in Southern Sinai (El-Shaer et al., 1982) have shown that the high level of supplement given to late pregnant-early lactating ewes and does, resulted in improving ($P<0.05$) birth weights and weaning weights of lambs and kids as compared to either the medium or low levels of supplement. From birth to weaning, average daily gains (ADG; g/d) of lambs born from ewes fed on the high, medium and low barley supplements were 270, 200 and 70 g/d, respectively) were 130, 112 and 72, respectively. Corresponding values for goats were: 50, 160, 210 g barley / animal /d and 56,62 and 63 g ADG. Milk production of both ewes and does was improved ($P < 0.05$) by increasing level of supplemental barley.

Dry matter intake from grazeable pasture native to Southern Sinai area (El-Shaer et al., 1982) and of Atriplex spp. (Shehata et al., 1987; Benjamine et al., 1986) increased when barley grains was given as a supplement to sheep or goats during late pregnancy and lactation. In these studies, DM and OM digestibility of the grazeable plants increased as a result of concentrate supplementation.

On-Field grazing trials conducted by Steele and Dutton, (1983 at Al Khaboura Station, Sultanate of Oman), showed that, a mature crossbred ewe of 40 kg average body weight, required 60-70 kg of pelleted concentrate mixture (60% TDN; 11% DP) during a period of 90 days of physiological stress (last 6 weeks of pregnancy and first 6 weeks of lactation).

Reproductive efficiency (as judged by lambing percent) of ewes and does grazing natural range pasture alone, did not exceed 45% (Benjamine et al., 1986). When a feed supplement of a high energy content was given in addition to grazing, lambing percent increased by 15 percentage units. Lambs per lambing was 1.33 and 1.53 for ewes grazing Atriplex spp. only and for those on Atriplex plus barley, respectively.

From previous data in the literature, regarding the effect of grazing alone or with added levels of barley grains as supplements, the author illustrated these data (figure 2) to describe its effect on either gain on weight in males or on lambing percent in ewes. Examination of this graph indicate that the magnitude of the effect of level of supplement on lambing percent in ewes is greater than on the gain in weight of mature males.

There is a relationship between feedstuffs supplementation, water consumption and moisture content of grazeable pasture. Water consumption by small ruminants especially sheep, increases with increasing dry matter from concentrated feedstuffs and is usually correlated with dry matter intake (Blaxter and Wilson 1963; Shkolnik et al., 1975; 1980). In goats, total water intake was linearly related to energy intake and grazing-lactating goats consumed twice as much water as grazing, non-lactating ones (Shkolnik et al., 1980; Wittenberg et al., 1986; Maltz et al., 1982). On the other hand, the relatively high moisture content of grazeable pasture in the wet season, decrease water intake by 60% in rams and by 25% in goats (El-Shaer et al., 1982; Benjamine et al., 1975). To support this finding, it has been reported (El-Serafy 1988) that a group of crossed rams (½ Awassi . ½ Omani) grazing Rhodes grass (73% moisture) consumed 50% less water than another group grazing indigenous perennials (42-48% moisture).

Integration of feedstuff supplementation with sheep production system in the NW arid area of Egypt

An illustration was made by the author (figure 2), in order to describe the productive flow-scheme for small ruminant production system in the NW region of Egypt and its relationship with range nutritive value and feedstuffs

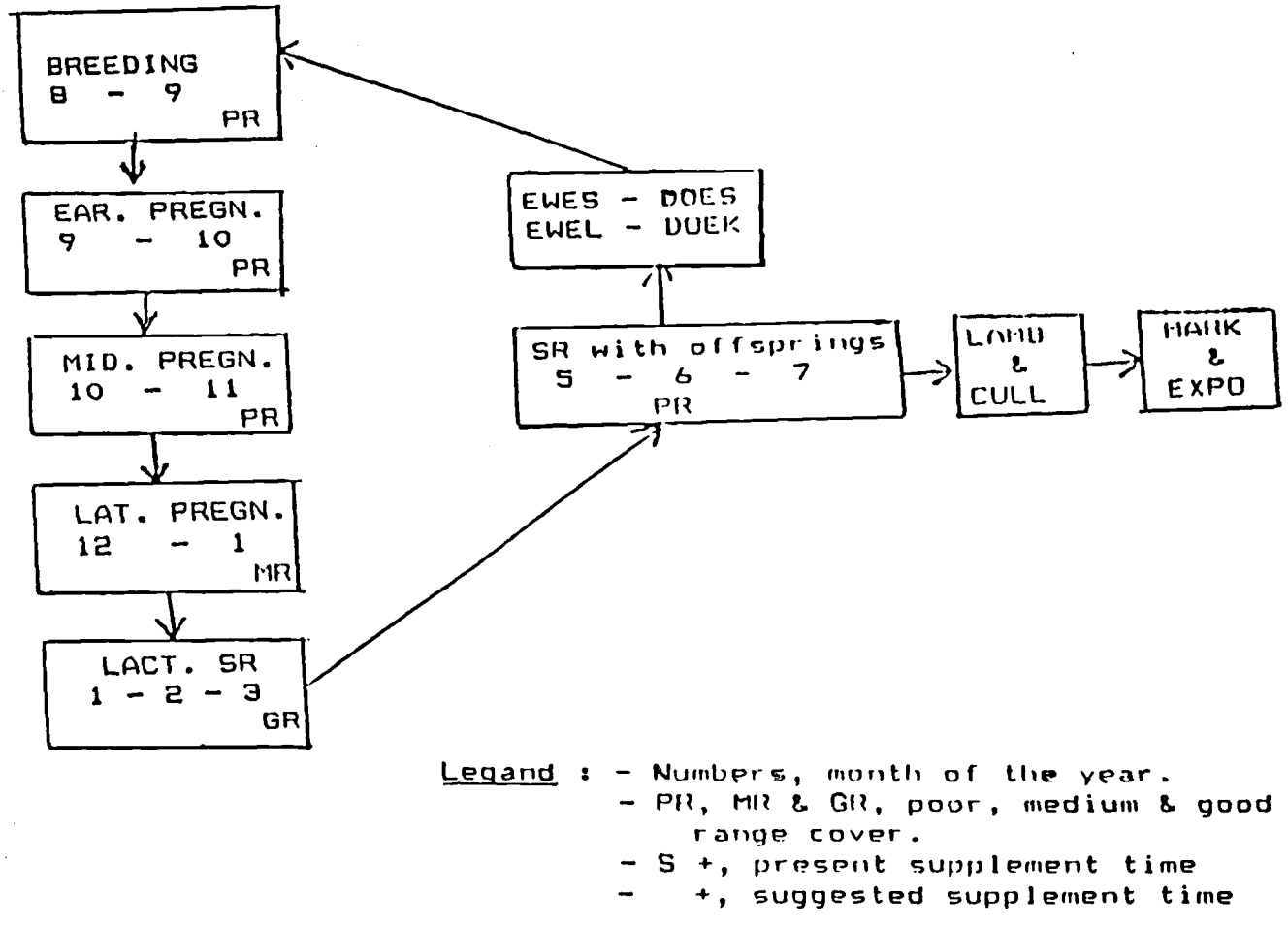

Figure: 2. Productive flow scheme for SR Production system in NW rangelands of Egypt: a suggested time for feedstuff supplement to the range.

supplementation. From this figure, it has been suggested that feed supplements to sheep grazing in this area, should be limited to times of late pregnancy and early lactation (December through March) although the situation of the range is relatively good. A small fraction of this supplementary feeds might be given in breeding time (August through September) where the range is described as relatively poor. This procedure is suggested to replace the common practice by range-users of giving feed supplements during the drought season (May through August).

Problems encountered with feedstuffs supplementation in range-pasture areas

From the above discussion it can be summarized that feedstuffs supplementation to ruminants grazing / browsing indigenous plants of arid and semi-arid zones, is sometimes necessary for maintaining a threshold performance of at least ewes. The onset of supplementation however, is of importance; feeds should be given in times of physiological stress than be given in drought season per se. Many socio-economic problems may arise however, from feedstuffs supplementation programmes. One of these serious problems is that range users may neglect or at least act reluctantly to developmental programmes aimed at range development: residing, improvement and reservation. In some cases, supplementary feedstuffs become a social habit which by time, is hard to abundant. Moreover, supplementary feedstuffs necessitate drilling of more water holes in some areas or at least increasing frequency of watering animals in others. In this situation, an increase in small ruminant numbers is unavoidable with the consequence of over-grazing and more deterioration in range productivity is expected. Added to that, more and more feedstuffs supplement will be needed; a viscous cycle which usually ends up with complete desertification of the range area.

In general, feedstuffs supplement programmes unless carefully designed and practiced, might lead to a serious damage to range productivity.

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