

FEEDING THE LIVESTOCK OF IRAN (Invitational Paper)¹

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Abstract — Feeding the livestock of Iran is now a critical problem because grazing lands are deteriorating and very little cropland is devoted to forage. A combination of reducing livestock numbers and an aggressive campaign to increase wheat and barley production (per hectare) to release land for forage production is proposed. Reduction in sheep and goat numbers need not lower meat production if accompanied by improved animal nutrition.

INTRODUCTION

Iran's livestock obtains most of its feed from grazing on natural vegetation. Shaidae and Niknam [19] report that nearly 70% of the feed of all livestock is natural forage. Most of the remainder is crop residues and the by-products of agricultural industries. The natural grazing lands of Iran are very extensive (approx. 100 million hectares). Because of limited precipitation, average production per hectare is low, but the total digestible nutrients produced exceeds that of all cropland. The livestock industry has developed largely without the benefit of cultivated forage crops. This is a characteristic of other arid countries, as pointed out by OEEC [15]: "The most important adverse feature of the farming systems of the Mediterranean peoples is the almost complete lack of integration of crop and livestock husbandry". Another adverse feature is the importance to the pastoral nomads of numbers of animals as a measure of wealth, the health and vigor of their animals being a secondary consideration. According to Naderi [12] "Nomads never sell their female animals unless they are sterile or too old to throw lambs. They generally do not slaughter their healthy animals". He estimates that about two-thirds of all sheep and goats in Iran are owned by the pastoral nomads.

Livestock numbers have increased in Iran during the same period of time that rangeland has been plowed under to increase cereal production [17, 14]. It is not surprising, therefore, that at some point in time the rangelands would no longer be able to provide the needed feed. This point in time has been reached in Iran, and in response to the pressure of too many animals, we now have general range deterioration.

Range deterioration is not new in Iran. Rangelands adjacent to villages have been overgrazed for many years. As village flocks increased, overgrazed range extended further

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out from the villages. Likewise, the migratory trails used by the nomads moving their flocks between winter and summer ranges have long been overgrazed. Jones [10] stated that "the weight lost during the migratory period each year is equal to the total annual slaughter of Iran". There is reason to believe, however, that until quite recently many of Iran's more remote summer ranges were still in good condition.

The general deterioration of rangeland has led to accelerated erosion by wind and water, and has placed the country's watersheds in jeopardy. Accelerated siltation of reservoirs is a threat to irrigated agriculture. General range deterioration also means that the range cannot continue to feed the number of livestock presently depending upon it.

These serious problems are growing worse with time. Prompt and effective action is required to hold the damage to a minimum and to bring about the earliest possible restoration to maximum forage production compatible with watershed protection. Effective solutions depend upon a proper understanding of the existing situation, and of the resources available to Iran with which to accomplish the desired improvements.

THE LIVESTOCK INDUSTRY

Statistics on livestock numbers in Iran are incomplete, and may be only approximations. Statistics gathered by LeBaron [11], supplemented by those in the FAO

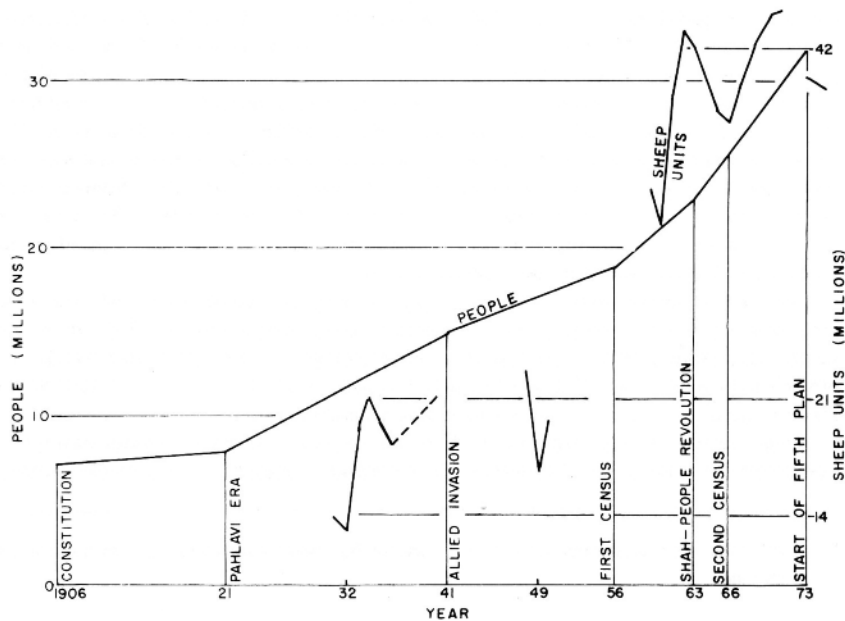


Fig. 1. Population of Iran 1906-1973 compared with sheep units of sheep and goats (records as available).

Production Yearbooks [5] and from the Iran Statistical Center [9], have been used to construct Fig. 1. The sheep and goat population of Iran, expressed in sheep units (one goat = 0.7 sheep units) has been charted with the human population, obtained from the *Iran Almanac* [8]. These data suggest that sheep units increased about 50% around 1931 and about 100% somewhere between 1951 and 1962. Fewer data on other classes of livestock indicate that there are approximately as many sheep units of all other classes of livestock combined as there are of sheep and goats [19]. Therefore, it is assumed that sheep and goats represent half the livestock in Iran when expressed in sheep units. What is the feed requirement of these livestock?

Niknam [13] estimated productivity of rangeland in Iran at about 230 kg dry matter/ha. Shaidae and Niknam [19] estimate the requirement per sheep unit at 300 feed units (approx. 240 kg TDN) per year. If we assume 100 million hectares of range and 84 million sheep units of livestock, we can calculate their need in relation to the approximate forage producing capacity of the range. These data have been used to construct Fig. 2. If we assume 60% utilization of the current year's growth, about 35% of the total feed requirement could be provided by rangeland. Proper utilization of the browse species most important to Iran has not been clearly defined, but there is some indication that browse generally will tolerate fuller use than grass [18]. In the arid western United States, grass ranges can be maintained with about 50% use.

If we accept that two-thirds (Shaidae and Niknam's "nearly 70%") of the feed comes from the range, we have approximately double the proper stocking. But Shaidae and

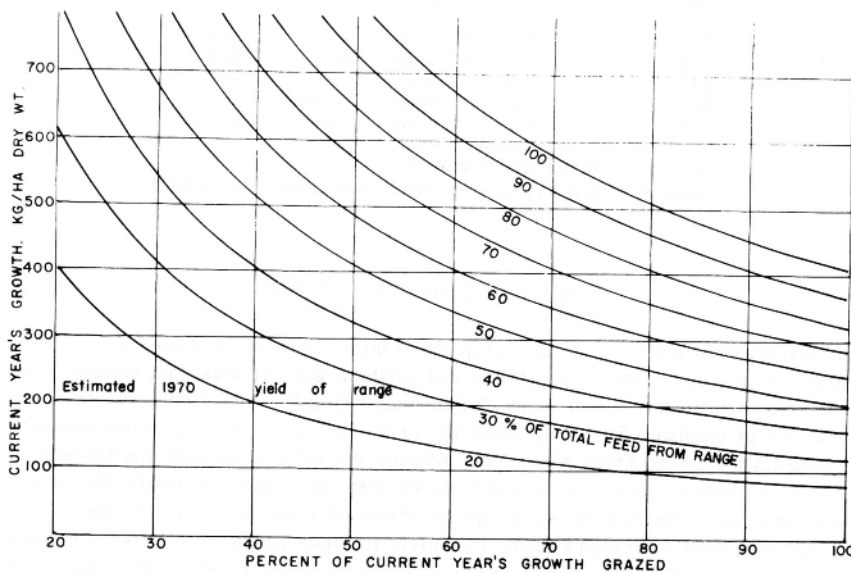


Fig. 2. The per cent of total feed provided by range as influenced by current year's growth and the percentage of it that is grazed.

Niknam [19] also estimated that the sustained carrying capacity of the range in 1970 was about 20 million sheep units. On this basis the 1970 stocking rate would be at more than 3 times proper range use.

There is much uncertainty about the maintenance requirement of sheep. O'Donovan [16] used 219 kg TDN/yr for a 45 kg Iranian sheep. The National Research Council of the United States, according to Terrill *et al.* [20], believe 365 kg TDN is necessary for a 50 kg ewe. With such divergent values, we have accepted the intermediate requirement of Shaideae and Niknam [19]. Depending on whose maintenance requirement is used, the rangelands of Iran in 1970 had anywhere between 3 and 7 sheep and goats where there should have been only 2. Under this intensity of use general range deterioration has set in, nutrition of the animals is very marginal, and it is conservative to agree with Shaideae and Niknam [19] that the range is now approximately 4 times overstocked. Possible range-livestock relationships from 1931 to 1970 are presented in Table 1, in a very generalized and simplified form.

Table 1. Relationships between estimated rate of actual stocking, assumed proper stocking, calculated overstocking and per cent deterioration of rangeland in Iran.*

Year	Estimated rate of stocking (1)	Assumed proper stocking (2)	Calculated overstocking (1)/(2)	Assumed deterioration, (%)
1931	28 million	42 million	none	none
1934-1956	42 million	42 million	none	none
1970	84 million	42 million [†]	2 times	none
1970	84 million	28 million [†]	3 times	33
1970	84 million	21 million [†]	4 times	50

* All livestock expressed as sheep units.

[†] Based on differences in assumed level of deterioration prior to 1970.

CROPLAND AGRICULTURE

Seventy-eight per cent of Iran's cropland is grown with wheat, barley and rice, but only 2% is grown with alfalfa. Maize and sorghum are not important enough to be reported as such, but appear under "other fodder crops" whose combined total is less than 4% of cropland. That only about 6% of the land under cultivation is grown with forage (in the United States about 19%) indicates the extreme pressure that farmers are under to produce crops consumed directly by man, or to meet his needs. The Iranian economy has not favored the widespread use of cultivated land to produce forage.

Entirely apart from man's needs, a deterrent to forage production in Iran is the arid climate with its shortage of precipitation for natural forage growth, and of water for irrigation. High yields of forage crops require more water than high yields of cereals. According to the World Bank [7] only one hectare in five of irrigated land in Iran has an adequate water supply, while the supply for three of each five hectares is entirely

inadequate for high crop yields. These limits on water, together with the uncertainty of a market, have contributed further to retard expansion of forage production in favor of wheat and barley. However, Ghadaki [6] in 1971, discussing forage problems in Iran, wrote "The establishment of a strong program to encourage forage and fodder production on cultivated lands is a further urgent task. In fact this is the key to the solution of the range problems of Iran."

THE SOLUTION

With rangelands overstocked and deteriorating, Iran is faced with the alternatives of drastically reducing its livestock industry or of enlisting the support of cropland to substantially increase the total forage supply, or some combination of the two.

Reduction of livestock numbers

This is without doubt the quickest and most effective way to correct overstocking. De Birchambaut [3], 20 years ago, wrote "In general, this regeneration of grazing lands cannot be obtained without at least a temporary reduction in the number of livestock". We have already noted that Iran's rangelands are overstocked to approximately four times proper use. However, not all ranges are equally overstocked. As a first step it is proposed that each flock be reduced by 50%. This should substantially reduce grazing pressure on the range, and slow down, if not stop, deterioration. Then, as rapidly as each range can be examined, a careful appraisal of its condition should be made to provide the basis for a more refined adjustment, to fit each specific case.

Reducing each flock by 50% should be accomplished by severe culling, retaining only the best animals. The Ministry should launch a vigorous campaign to instruct the shepherds in proper animal nutrition. According to Warwick [21], if properly nourished, only 34% of present sheep and goat numbers in Iran could produce as much meat and wool as the present population, and at a much greater efficiency of feed utilization. The importance of this observation cannot be overemphasized. Proper animal nutrition, as visualized by Warwick, results in lower death losses, higher reproductive efficiency and more rapid growth, and makes possible the marketing of more animals at an earlier age. His observation exposes the inefficiency of the present system and offers a logical approach toward balancing livestock needs with feed resources. To accomplish this will require demonstrating to the nomadic shepherds what proper nutrition can do; that it is to their advantage to own no more animals than can be properly nourished. It means that even where further reductions will be called for, in response to the more detailed survey, production need not fall below present levels if, in the meantime, the desired level of animal nutrition has become established.

A better level of nutrition will require that more concentrates be produced. According to O'Donovan [16], barley accounts for nearly half of the total concentrates fed. Other important sources are by-products such as wheat bran, beet pulp, beet molasses, cottonseed meal, and rice bran. He found that the energy and protein of the by-products feeds available in Iran, if fed in approximately the proportions produced, constitute a satisfactory diet.

The need for further reductions in livestock numbers can be minimized, if not completely offset, by production of more forage on cropland.

Other practices that will contribute to the adjustment of the range to animal numbers are as follows;

(a) Delay spring entry onto the range. If grazing is withheld until substantial spring growth has been made, vigor of the plants is greatly increased. Production of some grass ranges may be double that where grazing begins with the start of growth. However, to delay grazing one month means that the year before an additional month's supply of feed must be stored.

(b) Wherever possible, truck animals between winter and summer ranges. This will prevent the staggering loss in weight referred to by Jones [10]. This will also require harvested feed for the period the animals would otherwise be migrating. Where trucking is not possible, harvested feed should be provided along the migratory route.

(c) Promote range seeding where good cover is not present, but where soil, precipitation and exposure are satisfactory, and where subsequent management will insure the life and vigor of the seeding. A greatly expanded range research program is needed to provide the guidelines for successful seeding.

(d) Stop the indiscriminate plowing of range for the production of wheat and barley. A farmer wishing to plow rangeland should first be required to apply and obtain permission from an authorized certifying agency. No application would be considered unless the site met established minimum standards of slope, precipitation, soil depth and other considerations.

(e) Encourage the development of good quality water for animals without the necessity of their traveling long distances to find it. Truck water where justified.

(f) Foster research to evaluate several possible rotation grazing systems and other management practices to determine which are most compatible with the vegetation, soils and climate of each major area. Research should also determine proper use.

(g) The shepherd's attitude toward his animals must be shifted from one of being content with their survival to one geared to health, rapid growth and high efficiency of feed utilization.

Increasing forage production on cropland

If livestock are to fully utilize the range and be efficient producers, cropland must provide for their sustenance during periods when grazing is not possible (winter), or undesirable (spring), or when the supply of natural forage is inadequate (drought, migration, etc.). Cropland should also provide both forage and concentrates to prepare animals for market, and to insure proper nutrition during pregnancy and lactation.

The first and most fundamental development on cropland must be an increase in the yield per hectare of wheat and barley. There is no other way for enough land to be made available for growing forage. Figure 3 presents wheat yields for Iran and a few other selected countries. Note that only Iran failed to increase yield per hectare during the 21-year period. Only Pakistan, responding rapidly to the introduction of the Mexican wheats, was not reasonably represented by a straight line. Too few data are at hand to indicate changes in production over the years, of dryland vs irrigated wheat and barley. In round numbers, yield per hectare under irrigation exceeds yield on dryland by approx. 2.5 times.

Yields in Iran are not only low, they are not increasing, perhaps because rangeland is still being plowed to grow wheat and barley when conditions do not justify it. Yield of

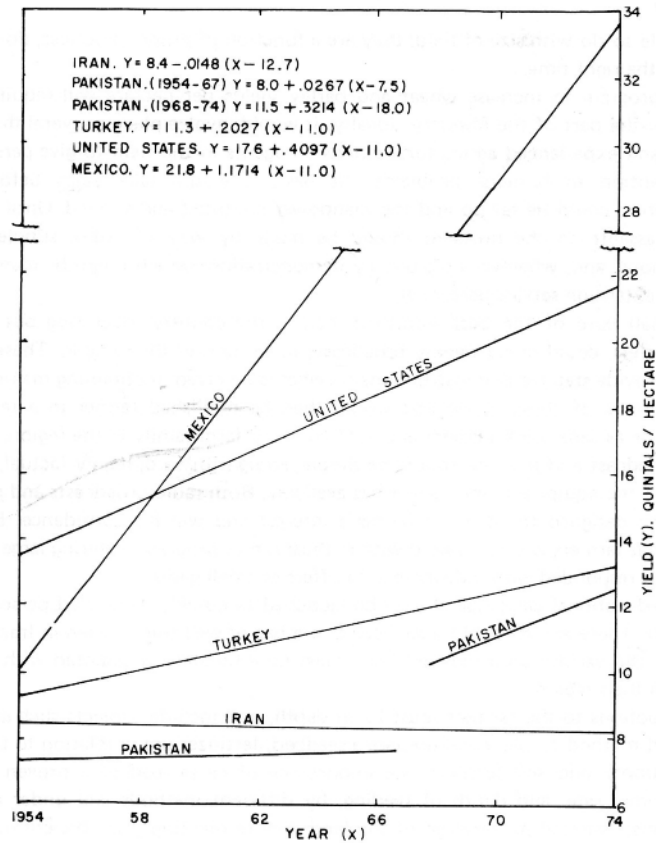


Fig. 3. Trend in yield of wheat per hectare, 1954-1974 inclusive. Selected countries.

wheat and barley on irrigated land can probably be doubled, and increased 20% on rain-fed land. When fully implemented such increases would release approximately one million hectares of irrigated land to grow forage, without lowering wheat and barley production. An additional million hectares of irrigated forage could supply all the needs indicated above for approximately 50% of present sheep units of livestock in Iran.

Forage production on an additional million hectares will allow Iranian farmers, for the first time, to take advantage of the soil improving effects of crop rotation. All forage crops add organic matter to the soil. Organic matter improves soil fertility and workability, and increases the soil's water holding capacity. According to Dewan and Famouri [4], Iran's soils are low in organic matter. In addition, legumes add nitrogen to the soil.

Maximum efficiency of production may require large fields, but high yields per hectare

have little to do with size of field; they are a function of proper practices, doing the right thing at the right time.

The program to increase wheat and barley yields per hectare will require a massive effort on the part of the Ministry. Ideally, it would involve placing several thousand well trained and experienced agricultural extension agents in the field to give personal advice and attention to farmers' problems. At best, it would take years before such an organization could be set up and the manpower recruited and trained. Until that time, a frontal assault on the problem should be made by way of radio, supplemented by publications, and, wherever possible, by demonstrations which might be managed by the existing extension service personnel.

A small core of the best informed men in the country, operating out of regional headquarters, could make weekly broadcasts to farmers of their region. These broadcasts would provide step by step instructions on what is involved in obtaining maximum yields. The contents of these broadcasts would then be published (either in a regional farm journal, or as separate bulletins) and sent to every farm family in the region. The advice, both broadcast and printed, should be simple, straightforward, highly factual, and should deal with the equipment the farmer has available. Both radio broadcasts and publications should be designed to hold the farmer's interest and win his confidence. Borlaug [1] found that farmers would respond with enthusiasm to programs offering large increases in yield, but responded with indifference to offers of small gains.

The educational campaign should be launched as quickly as needed personnel can be recruited. There are probably a sufficient number of well-trained men in Iran to man the posts in the various crop regions. They must be intimately acquainted with agriculture, and with their region.

Instructions to the farmers must be in depth, and include subjects such as the proper time and method to plow and prepare a seedbed; fertilizer use in relation to the crop, the water supply and soil fertility; the importance of clean seed of a proven variety and origin; time, rate, and depth of seeding, by different methods and under a variety of conditions; essential preparation of the land, before planting, for efficient irrigation; the importance of weed control, both before and after planting; recognizing and combating insects and diseases injurious to his crop; irrigation in relation to his water supply, the crop, other crops needing water, soil depth, fertilizer use and timing; planning a crop rotation to fit the circumstances; farming practices to minimize erosion; annual legumes, for rotation with wheat and barley on rain-fed land; possibilities of double cropping; value of animal manure to increase soil fertility, organic matter, and water holding capacity; summer fallowing dryland to conserve moisture; efficient practices in grain harvesting, threshing, cleaning, and storing; crop marketing; the wise use of credit, and where and how to get it; opportunities for cooperation with neighbors; effective use of slack time; and keeping records.

The Ministry will realize that a small core of men, coming into each region to launch the educational program, cannot be expert in all things. They will therefore arrange seminars as frequently as necessary, where the subjects to be presented to farmers will be previewed in detail. The regional men can then adapt the information obtained to the circumstances of their region.

A farm journal, if each region could support one, would be an excellent avenue of communication to support the broadcasts. It would give support to the literacy program.

It could contain much information of value to all rural families, dealing with such topics as nutrition, sanitation, health, clothing, child care and rearing, and many others, in addition to every kind of farm information.

While the educational program is getting under way, the Ministry could immediately put several actions into operation:

(a) Require every livestock owner to grow or buy 0.2 tons of dry forage per sheep unit owned. This would move the shepherd toward a concept of nutrition, and help him through periods of feed shortage. The total feed produced would be considerable, but it would be equitably distributed. The tribes could participate in this program if land brought under new irrigation projects was traded to them for sheep and goats. If the tribes did not want to farm the land themselves, they could operate it as a collective enterprise, with hired management. The feed produced could be fed at tribal feedlots. In a like manner, the villagers might be encouraged to pool their land for forage production, and with the forage produced operate a village feedlot.

(b) Set a minimum price for alfalfa and other forage crops, high enough to encourage their production. This would take the uncertainty out of marketing the crop.

(c) Speed up the lining of canals under all irrigation projects. More water will become available when seepage losses are stopped.

(d) Speed up availability of certified seeds of the best cereal and forage crops.

(e) Push the growing of maize and sorghum where adapted, both for seed and for silage. Maize is well known as capable of producing more TDN per hectare than any other crop. Sorghum is not far behind.

(f) Require a percentage of all new land brought under irrigation to be used for forage production.

The above are not six isolated areas for possible action. All should be pursued in every situation where they can be used to contribute toward forage production and improved agriculture generally.

DISCUSSION

Brown [2] has pointed out that every developing country goes through a transition from area-expanding to yield-increasing agriculture as the population begins to tax the land resources. This transition is called a yield take-off. It is a necessary step in Iran now, not only because the needs of Iran are beginning to tax the land resources, but also because only by this process can land be made available to meet the nation's forage needs.

Iran appears ready to make this transition. Brown [2] lists the essential requirements as (a) a fairly high level of literacy, so that information can be disseminated by publications (literacy is advancing rapidly in Iran), (b) capital to finance the inputs needed (the rapidly rising per capita income in Iran fills this need), (c) a market oriented, as contrasted to a traditional subsistence-oriented economy (early stages of this transition are evident in Iran) and (d) the development of businesses and industries which support agriculture, but do not engage in it (these are also in evidence, but will need substantial development). Brown might also have listed the organizational structure that would insure obtaining the information farmers need, and the means by which this

information is effectively communicated to them. This is where the various Ministries have vital roles to play.

This paper has attempted to spell out the problem and suggest a possible solution. Overstocking, and with it range deterioration, is an accepted fact. It is urgent that prompt action be taken to stop this deterioration. The development of the livestock industry and cropland agriculture quite independently of one another is also obvious. It is interesting that the need to unite the two should occur just when all the factors essential to a yield take-off are materializing. In Iran, steeped in centuries of tradition opposing change, there must be a strong motivating force to not only sponsor the movement, but to carry out the various functions essential to its success.

Prompt and effective action should produce the following results:

- (a) Earliest termination of range deterioration and restoration to maximum productivity.
- (b) Establishment of the livestock industry on a sound footing.
- (c) A maximum contribution toward meeting the red meat needs of the country.
- (d) Safeguarding the nation's watersheds, and irrigated agriculture.
- (e) Improving the standard of living of all rural people.
- (f) Improving the productive potential of cropland.

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