AGRICULTURAL CHANGE IN TURKEY: AN EXAMPLE FOR THE MEDITERRANEAN REGION?

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Abstract

A retrospective description is presented of agricultural development in Turkey, stressing the food crop and livestock sectors over the four decades following the Second World War. This reveals considerable success in increased production of field crops, particularly wheat, barley and pulse grains at the expense of a major reduction in land previously under permanent pastures and ranges. Additionally, the potential productivity of the livestock sector has not been realized, partially as a result of inadequate feed supply. Production increases have not been equitably distributed throughout Turkey, and in consequence Eastern Anatolia remains largely undeveloped. The sustainability of production of the current cropping system is questionable, particularly where continuous cereal crop sequences are practiced and where risks of soil erosion using a bare fallow system are high. The success of current fallow replacement policies suggest improvements are possible for the development of more sustainable cropping sequences for the future. Suggestions are made by which other countries in the Mediterranean region could develop their agricultural systems as a result of lessons gleaned from this Turkish experience.

Résumé

Une déscription rétrospective du développement agricole en Turquie est présentée, mettant l'accent sur les secteurs de production de cultures alimentaires et de l'élevage durant les quatres décennies suivant la Seconde Guerre Mondiale. Cette déscription revèle un succès considérable en l'augmentation des cultures des champs, en particulier du blé, de l'orge at des légumineuses, aux dépens d'une réduction importante des terres antérieurement allouées aux pâturages permanents. En plus, la productivité potentielle du secteur de l'élevage ne pas été réalisée, en partie due à un manque de fourrages adéquats. Les augmentations de production n'ont pas été distribuées de manière équitable partout dans le pays, et par conséquence l'Anatolie orientale demeure largement sous-développée. La continuation du système actuel de cultivation pose des problèmes, en particulier là où une cultivation continue de céréals est pratiquée, et où le risque d'érosion des sols est élevée si des jachères nues sont utilisées. Le succès des politiques actuels de remplacement des jachères indique que des améliorations seront possible pour le développement à l'avenir de successions de cultures plus soutenables. Des suggestions sont faites, selon lesquelles d'autres pays de la région Méditérranéenne pourront développer leurs systèmes agricoles en profitant des leçons gagnées de l'expérience de la Turquie.

Turkey is the leading wheat (Triticum aestivum) and food legume producing nation in the Mediterranean region (Oram and Belaid, 1990). This position is the result of substantial change in agricultural structure and development in the last 40-50 years. This paper describes the situation in Turkey immediately after the Second World War and examines developmental changes up to the late 1980s. The objective of this recapitulation is to examine whether or not production from the current agricultural system in Turkey is sustainable in the long-term and to consider whether Turkey's experience can be of benefit to the other countries in the Mediterranean region who are seeking to develop the agricultural sector of their economies.

Mann (1980) and Durutan et al. (1988) have reported the very large increase in cereal production (particularly wheat) which occurred in Turkey shortly after 1950. This consisted of two specific phases of development: a marked increase in the area of crop production, largely cereals, due principally to rapid mechanization prior to 1960 (**tables 1** and **2**), followed by a more gradual and less uniform increase in production per unit area (**table 3**) due to the introduction of improved varieties (CIMMYT, 1989), favourable price policies, availability of inputs, improved production technologies, especially improved fallow management and fallow replacement (Mann, 1980; Durutan et al., 1988; Yesilsoy, 1988), and an increase in the area under irrigation. Turkey achieved self-sufficiency in wheat in the early 1970s and has subsequently become a major exporting country. Turkey also more recently became a world leader in the export of lentil (Lens culinaris) and chickpea (Cicer arietinum). This enhanced crop productivity has been coupled with a gradual but consistent increase in the number of sheep (Ovis spp.) until the mid-1980s, with an initial slight increase followed by stagnancy in the populations of goats (Capra spp.) and cattle (Bos spp.) (**table 4**; GOT 1954, 1968b, 1989, 1991). The very substantial areas of permanent meadows and pastures (41 million ha in 1938 and just over 34 million ha in 1952) have declined considerably as a result of the doubling, approximately, of the cultivated area and land allocated to forestry (**table 1**; GOT 1954, 1968b, 1990a; Sahin and Ozugur, 1976).

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Superficially, Turkey's experience appears to be a successful example of agricultural development in the Mediterranean region from which lessons for other less developed countries could perhaps be gleaned. However, the more detailed examination which follows may cast some doubt on the sustainability of production of the current system and of the imbalance in developmental output as a result of a long-standing favourable policy environment for grain production (Aresvik, 1975; Mann, 1980).

Status of agriculture in Turkey 1946-52 and changes in the 1950s

Just after the Second World War, agriculture in Turkey remained largely undeveloped and was dependent on animal traction power. In the 20 years between 1947 and 1967 the land area cultivated by tractors increased from less than 200,000 ha to more than 5.5 million ha (GOT, 1968b) and the number

Table 1 ***Agriculture in Turkey over four decades 1947-87.***

Land use	Millions of hectares				
	1947-52 (*)	1957	1967	1977	1987
Sown annually	8.9 (1947)	14.4	15.5	16.5	18.8
Fallowed annually	4.6 (1947)	7.8	8.3	7.9	5.6
Forests	10.4 (1952)	10.4	12.6	20.1	20.2
Horticultural crops	1.7 (1952)	1.9	2.4	2.6	3.6
Meadows and Pastures	34.8 (1952)	29.7	26.1	17.9E	16.8E
Wastelands	13.5 (1952)	13.5	13.1	13.1A	13.1A
Total area	77.7 (1952)	77.7	78.0	78.1	78.1

(*) Years selected are not averages for the period 1947-52 but the earliest available year in the summary statistics.
E = Estimate made by subtraction
A = Assumption that lake and marsh areas have not decreased.
Source: GOT 1954, 1968b, 1990a and 1990b.

of tractors increased correspondingly from just over 1,500 to close to 75,000 in the same time period. However, there was no consequent reduction in the number of draft animals in use which remained constant at around 2.5 million pairs. The implication is that considerable additional amounts of land were being cultivated either more regularly or for the first time, as is evident from Balaban (1972) and Mann (1980). The land area under cultivation increased from 13.5 million ha in 1947 to its apparent maximum ceiling of between 23 and 24 million ha by the mid 1960s where it has remained ever since.

The majority of the 8.9 million ha sown in 1947 (**tables 1** and **2**) were under cereal crops, of which 4.2 million ha were wheat and 1.8 million ha were barley (Hordeum vulgare) (**table 2**) and with a substantial additional cultivated area under fallow (4.6 million ha). Food and forage legume crop hectarage was very small, as was the area of industrial and oilseed crops such as cotton, sugar beet and sunflower (**table 2**). However, pulse crops showed no major increase in the 10 years after 1947, whereas industrial and oilseed crops doubled their sown area. Yields of all crops were low, seldom exceeding 1 t ha^{-1} of grain (**table 3**). However, the very large area of meadows and pastures (34.8 million ha) plus some contribution from wastelands (lake surfaces 10.7 million ha, marshes, mountain tops etc. 2.4 million ha) suggests that natural permanent pastures and rangelands existed which were capable of providing considerable quantities of animal feed. Bakir (1972) estimated that in 1945 the rangelands in Turkey had an average carrying capacity of 2.2 (250 kg) animal units per hectare and in 1950 there was an additional 11.3 million tonnes of straw and stubble available for livestock use. Hay production in 1950 from all common pastures and rangelands in Turkey was estimated by Sahin and Ozugur (1976) to be just under 23 million tonnes. These feed resources, including most of the barley production, supported approximately 40 million head of small ruminants and just less than 10 million head of cattle in 1947 (**table 4**).

The extremely rapid increase in the area of land which was cultivated between the late 1940s and late 1950s (**table 1**) suggests the advent of mechanization relieved a severely limiting factor to national production. This improved technology apparently required minimal extension effort as there was less than one extension officer for every 11,000 members of the agricultural community (ages 15-64) (GOT, 1954).

One additional factor which may be inferred from the agricultural statistics for the early post-war period 1947-52 (GOT, 1954, 1968b) is that a 2-year cereal fallow crop sequence was probably the dominant dryland farming system (Guler and Karaca, 1988), but also the discrepancy between the totals for the area sown and fallowed each year implies that a substantial amount of cereals were produced in monoculture or in multiple cereal/single fallow sequences. This has implications for the long-term ability of the soil to sustain the production system as in the immediate post war period inorganic fertilizer application was virtually unknown in Turkey (Aydeniz, 1975; GOT 1973). Also, soil erosion was recognised, following the increase in cultivated area in the early 1950s, to be a serious problem almost immediately following initial cultivation (FAO, 1959).

Table 2 ***Area sown to annual crop classes and specific annual crops over four decades of agriculture in Turkey, 1947-87.***

	Millions of hectares				
	1947	1957	1967	1977	1987
Crop class					
All cereals	7.6	12.2	13.0	13.6	13.9
All pulses	0.4	0.5	0.6	0.7	2.1
All oilseeds	0.4	1.0	1.1	1.3	1.6
All industrials	0.6	1.4	1.7	1.4	1.3
Crop					
Wheat	4.2	7.2	8.0	9.3	9.4
Barley	1.8	2.6	2.7	2.6	3.3
Lentil	0.05	0.08	0.10	0.24	0.92
Chickpea	0.08	0.08	0.09	0.14	0.67
Vetch (*)	0.13	0.19	0.21	0.17	0.24

(*) (*Vicia* spp.).
Source: GOT 1968b, 1990a.

Table 3 ***Yields of specific annual crops over four decades of agriculture in Turkey, 1947-87.***

	Tonnes $hectare^{-1}$				
Crop	1947	1957	1967	1977	1987
Wheat	0.8	1.2	1.3	1.8	2.0
Barley	0.8	1.4	1.4	1.8	2.2
Lentil	0.7	0.9	1.1	1.1	1.0
Chickpea	0.8	1.1	1.1	1.3	1.1
Vetch	0.8	1.0	1.0	0.9	0.9

Source: GOT 1968b, 1990a.

Table 4 ***Livestock (millions of head) in Turkey 1947-87.***

	1947	1957	1967	1977	1981 (*)	1984 (**)	1987
Sheep	24.6	29.2	35.9	42.7	49.6	40.4	43.8
Goats	13.1	17.2	15.2	14.8	15.1	11.1	11.1
Angora Goats	4.2	5.6	5.5	3.5	2.9	2.0	2.0
Cattle	9.8	12.0	14.2	14.5	16.0	12.4	12.7
Horses	1.1	1.3	1.2	0.8	0.8	0.6	0.6
Donkeys	1.7	1.8	2.0	1.4	1.3	1.2	1.2
Buffaloes	0.9	1.1	1.3	1.0	1.0	0.5	0.5

(*) 1981 was the year in which total ruminant numbers were at a maximum.
(**) 1984 is the most recent year for which figures are published from a general livestock census.
Source: GOT 1968b, 1990a.

Changes in agriculture in the 1960s

By the late 1960s Turkey was self sufficient in wheat production, but with the rapid rate of population increase in excess of 2.5% per annum (GOT, 1973, 1990b), domestic supply was perceived to be a continuing problem requiring additional research effort to realize the agriculture potential of the Anatolian drylands (Demirlicakmak, 1972). The Turkish nation has one of the highest per capita consumptions of wheat products in the world (CIMMYT, 1989) and wheat is thus regarded as being of particular national importance (Yesilsoy, 1988). Regular use was beginning to be made of inorganic fertilizer over quite large land areas (more than 4 million ha, GOT, 1973) and improved semi-dwarf wheat varieties were being introduced (CIMMYT, 1989). However, around two-thirds of all the cultivated area was still being worked by animal draught power (GOT, 1973). Additionally, there was no major increase in the area of pulses and

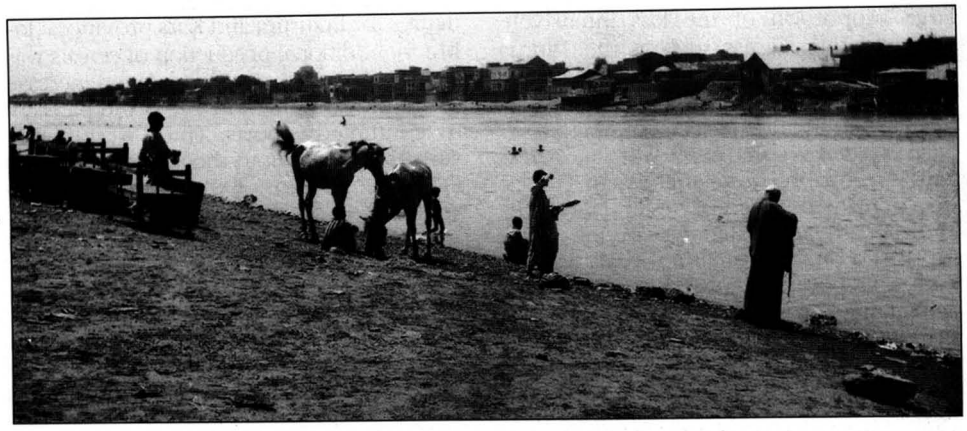
yields remained at levels close to 1 t ha^{-1} (**tables 2** and **3**).

By 1967 the livestock population had risen to more than 56 million small ruminants and 14 million head of cattle and Akyildez (1972) calculated that the livestock sector produced 36.9 % of the national agricultural income. However, by this time Bakir (1972) estimated that the area of rangelands had been reduced from 34 to 28 million ha and these lands possessed a carrying capacity of only 1.1 (250 kg) animal units per hectare. Sahin and Ozugur (1976) estimated national hay production from pastures and ranges to be just under 17 million tonnes in 1965, which is 5 million tonnes less than in 1950. It is evident from this reduction in carrying capacity that the most productive permanent pasture land had been removed from the grazing system for cropping purposes (Mann, 1980), which resulted in the removal of substantial animal feed resources. In partial compensation, estimates of the actual feed contribution from straws and stubble had risen to nearly 25.5 million tonnes (Bakir, 1972). At the same time, the compound feed industry was rapidly developing in Turkey. Output of feed increased from 585 tonnes in 1958 to close to 87,000 tonnes in 1967 and was projected to reach 325,400 tonnes in the 1970s (Ustunsoy, 1972). However, almost 60% of output was used as poultry feed, rather than for ruminants, with barley grain being a principal raw material.

Almost all rangelands in Turkey are technically government owned, but village communities maintain common grazing rights under legislation not effectively amended since the nineteenth century (Aksoy et al., 1980). As a result, with diminishing land resources, widespread uncontrolled grazing occurred and severe soil erosion was further in evidence on at least 9% of the geographic area of Turkey (Uslu, 1972), particularly in the drier areas of Konya province in Central Anatolia. The resultant fodder deficiency was estimated to be large (Bakir, 1972) and in consequence meat and milk yields were considerably lower than their potential. Rhodes (1969) outlined the policy options available to the Turkish Government concerning the cereal and livestock industries and concluded that a simple policy of wheat maximization would not be as profitable as an integrated policy of cereal and livestock feed production.

Changes in agriculture in the 1970s

The period 1968-77 saw a substantial increase in the average yields of wheat and barley largely as a result of improved agronomic practices (tillage and addition of inorganic fertilizer) and, in the case of wheat, the wide-scale introduction of semi-dwarf wheat varieties in irrigated and high potential rain-fed areas. This permitted Turkey to become, in some years, a major exporter of «cereals and cereal preparations» (e.g., 2.1 million tonnes in 1978 including approximately 100,000 tonnes of pulse grain). Areas where the climate is more marginal for wheat and barley production, such as Eastern Anatolia remained unaffected by these technological innovations. For example, in **table 5** wheat and barley yields are reported for six Turkish provinces selected to represent variability in environmental conditions. Hence, Adana and Edirne typify relatively favourable lowland environments, Corum and Konya somewhat harsher highland conditions representative of Central Anatolia and, Erzurum and Kars are representative of the very harsh environments of Eastern Anatolia. The data shown in the table indicate clear differences in the adoption of improved agronomic techniques and varieties, particularly wheat, resulting in the contrast of a two- fold increase in yield in favourable environments compared with no increase in harsh environments. This failure of farmers to adopt new technologies is probably not a result of inadequate agricultural research owing to insufficient investment of resources by the Government, as the Eastern Anatolian Research Institute at Erzurum was established in the 1920's and Ataturk University, also based at Erzurum, has one of the longest established agricultural faculties in Turkey. The problem appears to be complex and even today remains unresolved. This 10-year period again saw no real increase in pulse crop area and yields did not appear to be influenced by improved agronomic practices such as addition of fertilizer. However, research was being performed on improving forage legume production through fallow replacement and improved agronomy (Cayir-Mer'a ve Zootekni Arastirma Enstitusu, 1973a, 1973b). There was a minor increase in oilseed crop area but this was matched by a decline in industrial crop hectarage.



The period 1966-77 saw a very large increase from approximately 10 to 20 million ha in the area of land designated as forests in Turkey (**table 1**). This increase is perhaps too large to be accounted for solely by a major investment in new plantings, and incorporates a redefinition of what was, and was not, public and private forest land at the expense of what was previously defined as pasture and rangeland (the redefinition incorporated scrub forest and land dominated by perennial shrub species). Unfortunately, at the same time the Government of Turkey ceased to report the area of pastures, meadows and rangeland. This makes estimation of the area of land available for grazing very difficult. However, it may be estimated that by 1977, meadow and rangeland areas were reduced by a further 8 million ha to 17.9 million ha (**table 1**). Sahin and Ozugur (1976) suggest an estimate of 21.7 million ha for 1975, which is in line with the 1977 estimate. This represents an approximate halving of grazing area in a 20-year period. It also should be recognized that, although grazing is illegal in most state forests, grazing activity still continues in a

Table 5 ***Yields of wheat(W) and barley(B) in six provinces in Turkey over four decades, 1946-87.***

	Tonnes $Hectare^{-1}$							
	1946-50		1966		1977		1987	
Province	W	B	W	B	W	B	W	B
Adana	1.1	1.0	1.4	1.8	2.5	1.9	4.0	2.5
Corum	0.9	1.0	1.4	1.7	1.4	1.8	1.9	2.3
Edirne	0.8	0.9	1.3	1.3	2.6	1.6	3.2	3.2
Erzurum	0.9	1.1	0.9	1.3	0.9	1.0	1.1	1.7
Kars	0.9	1.1	1.0	1.2	1.0	1.1	1.1	1.5
Konya	0.8	0.9	0.9	1.0	1.7	2.4	1.9	2.4

Source: GOT 1954, 1968a, 1979 and 1989.

large proportion of the less intensively managed forest areas such as the Taurus mountains and land dominated by shrub vegetation. However, the worst excesses of overgrazing and de-forestation seem to have been avoided as social control of State forest land is (probably) more effective in Turkey than in many other countries in the region. Munzur (1989) estimated the carrying capacity of the remaining natural pastures and ranges to be approximately 0.8 (250 kg) animal units/ha in the late 1970s. The average range carrying capacity probably fell in the 10-year period under discussion as sheep numbers continued to increase substantially, but without much change in goat and cattle numbers (**table 4**). Sahin and Ozugur (1976) estimate that, with 27.5 million animal units in Turkey in the mid-1970s, there was a range grazing capacity only sufficient for 12 million animal units. Furthermore, they claim that uncontrolled grazing and inadequate pasture management have resulted in a substantial reduction in pasture and range productivity. Munzur (1989) estimates that hay production from meadows and pastures in the late 1970s and early 1980s would have been approximately 450 kg ha^{-1} in Central Anatolia (28 % of the national total area) and up to 900 kg ha^{-1} in Eastern Anatolia (41% of the national total area). Some decline in draught animal numbers is evident: from a maximum 2.7 million pairs in the mid 1960s to just under 2 million pairs in 1977 (GOT 1968b, 1990a).

The relative increase in cereal production may have contributed additional straw and stubble feed for livestock over and above the estimate of 25.5 million tonnes for the late 1960s (Bakir, 1972). However, as this increase in yield coincided with the greater growth of semi-dwarf cereal varieties, less straw would have been available than the increase in grain yield would imply. A change in harvest index for the areas planted with improved wheat varieties from approximately 0.32 to 0.38 in this period is likely to have occurred (H-J. Braun pers. comm. 1992).

Changes in agriculture in the 1980s

Rising wheat and barley production and use of inorganic fertilizer (on 16.6 million ha in 1987, GOT, 1990b) continued to be a feature of Turkish agriculture in the period 1978-87, largely as a result of increasing yields per unit area in the favourable lowlands, irrigated areas and, more than previously, in Central Anatolia (**table 5**). Increases in Eastern Anatolia were much smaller or nonexistent for wheat, even though the technical feasibility of substantial yield increases in wheat had been demonstrated at a research plot scale for the cold areas of Eastern Anatolia such as Sivas (Durutan et al., 1988). There was some response in barley, as is indicated by the figures for Erzurum and Kars provinces (**table 5**). Additional production of cereals was absorbed, partially by a population increase to around 53 million in 1987, and partially by continued exports. These were highly variable according to the specific environmental conditions. Exports of combined grains (cereals and pulses) varied from 201,906 tonnes in 1986 to 2,912,189 tonnes in 1988 (GOT, 1990b). Animal feed imports became an important trade variable for the first time, albeit much less than grain exports. In 1977 Turkey imported 771 tonnes of animal feed (not including unmilled cereals). In the late 1980s this had increased considerably to close to 50,000 tonnes (1984-88 average; GOT, 1990b).

The major new success story in Turkish agriculture for the 1977-87 period was the very rapid increase in pulse crop area from 0.7 million ha in 1977 to 2.1 million ha in 1987. This was achieved as a result of an intensive research and extension campaign directed at replacing fallow in crop sequences with chickpea and lentil crops in areas with annual rainfall exceeding 410 mm (Guler and Karaca, 1988). This program was aimed particularly at Central Anatolia, and Corum and Cankiri provinces were selected as the pilot introduction areas for this improved technology in the late 1970s. Subsequently, this effort was extended nationally (Durutan et al., 1990). Previous fallow replacement projects had been prepared but were not adequately supported (Cayir-Mer'a ve Zootekni Arastirma Enstitusu, 1973a; M. Pala, pers. comm., 1992).

The impact of this new technology was substantial in parts of in Central and Southeastern Anatolia where its adoption was enhanced by generous price support policies, but was not discernable in Eastern Anatolia (**table 6**). This may be related to the unsuitability of the present landraces for the more severe Eastern climatic conditions. The production increases resulted only from the greater sown area for chickpea and lentil crops and yields per unit area remain today at the very low levels of the immediate postwar years (**table 3**). However, some improvements in agronomy occurred, such as better landrace seed, which maintained the provincial average at a constant level when there was an expansion in production area including more marginal environments (M. Pala, pers. comm., 1992). Nevertheless, on the strength of this markedly improved production, by the late 1980s Turkey was the world's largest exporter of these food legumes earning 220 million US dollars in 1986 (Oram and Belaid, 1990). This must imply a very respectable rate of return to investments in research and extension.

The increase in area of food legume crops in replacement of fallow may be considered desirable in terms of the adoption of a crop sequence with a greater likelihood of long term sustainability of production. However, the additional area sown to these crops would not appear to account for all the reduction in fallow area. The data presented in **tables 1** and **2** suggest that barley hectarage also increased and that the proportion of sown area to fallow fell considerably below the value of 50% which it had held in earlier decades. This implies a further increase in continuous cereal production, concentrated possibly in both irrigated and the drier barley-growing areas, which in the latter case is not a sustainable development in the long-term as has been observed in neighbouring countries such as Syria (Jaubert, 1983).

For the livestock sector the picture is a good deal less clear. By 1981 sheep and cattle populations were at a maximum, having increased substantially from 1977. However, by 1984 the population had apparently declined (**table 4**) with a partial recovery in sheep numbers in the period 1985-89 (GOT, 1991). The current position is very hard to substantiate as the Government of Turkey has not produced livestock data regularly since 1985, and this apparently large decrease in livestock numbers (whether real or unreal) was a topic of parliamentary debate.

It is a safe assumption, however, that considerable feed deficits were experienced, particularly in Eastern Anatolia where the majority of animals are concentrated. This area has received the least benefit from the improvements in crop production which have occurred in the last 40 years. However, research efforts to improve the productivity of pasture and forage land in Eastern Anatolia are actively being pursued by the Government (UNDP, 1988), but these efforts have not had an immediate impact on animal feed availability in Eastern Turkey. GOT (1984) reports that for 1982 only 26.5% of animal feed requirements were be-

Table 6 ***Area of chickpea (CP) and lentil (LE) production in four provinces in Turkey, 1977-87.***

	Hectares			
	1977		1987	
	CP	LE	CP	LE
Province				
Corum (C. Anatolia)	1,897	3,070	11,793	44,873
Diyabakir (S.E. Anatolia)	2,850	3,470	32,764	135,603
Erzurum (E. Anatolia)	1,570	2,245	288	2,395
Yozgat (C. Anatolia)	2,050	4,300	26,582	93,222

Source: GOT 1979, 1989

ing met nationally by natural pastures and ranges and 50.9% were provided by crop grain, straw, stubble and green leaves with a further 9% being provided by industrial crop residues. Additionally, a further 5% decrease in the contribution from natural pastures and ranges is predicted for 1994, irrespective of the further loss in natural pasture and range area postulated by 1987 (**table 1**). The study concludes that livestock numbers in Turkey by 1982 had reached the point of periodic overstocking and that livestock output would in consequence be limited, particularly as most available feed materials were better suited to animal maintenance than to production because of their low quality (GOT, 1984).
Another major change in the livestock sector was the considerable reduction in numbers of draught animals. These numbers fell from just under 2 million pairs in 1977 to 1.3 million pairs by 1984 when the figures were last recorded. In the same period, tractor numbers increased from more than 320 thousand to 557 thousand in 1984 and to 655 thousand by 1988 which would imply a further reduction in draught animal numbers even after 1984 (GOT, 1990a).

Turkish agricultural development 1947-87

Over the 40 year period since the Second World War, Turkey has had a large measure of success in its agricultural development principally based on improved wheat production, a large ruminant population and more recently food legume and horticultural crop production. However, benefits derived from this development, irrespective of Government desire, have not been equitably distributed, with Eastern Anatolia receiving the least share. The Government of Turkey has maintained a favourable policy environment for food grain production (Rhodes, 1969; Mann, 1980) and has been much more successful in encouraging wheat and food legume productivity than in developing effective production stimuli for the livestock sector. This does not imply that the Government wished to favour wheat production over livestock production, but rather that they were much more successful with cereal policies than with livestock policies. This has resulted in a situation of imbalance between these two production sectors, in which the long-term success with food grain production has been at the cost of livestock production. The outcome of this imbalance may not be economically justifiable but can be understood in political terms. Policy incentives for food grain production have more visibility and a shorter return period than is perhaps the case for similar incentives in the livestock sector. It also may be a factor in the inequity of the distribution of the benefits of recent agricultural development as livestock production is concentrated in Eastern Anatolia.

In terms of risks of damage to the natural resource base, aspects of Turkish agricultural development may be viewed quite critically. The loss of major areas of permanent pasture for increased cereal cultivation is probably not sustainable in the drier areas of Anatolia and this has been the cause of severe soil losses through water and wind erosion. Where this has been coupled with an increased tendency to grow cereals continuously, marked degradation of soil resources is likely to, or has already taken place and a rapid return to permanent pasture of vulnerable land classes (dry areas, sloping land, soils with low organic matter status etc.) would probably be desirable and profitable in areas where livestock are, or could be, concentrated (Elci, 1972). The current «free for all in the village» approach to common grazing rights on village pastures and ranges has resulted in severe long-term overgrazing and consequent permanent reduction in the livestock-carrying capacity of grazing lands. Legislation is urgently required to allow improved management to be practiced on these common lands (Bromley and Cernea, 1989). Attempts to introduce and pass such legislation have been made in the past, but these have proved either to be ineffective or unable to muster sufficient political support to be implemented.
A more intensive attempt to provide additional animal feed resources from current crop production by possibly substituting barley for wheat and encouraging further forage legume production would likely to be advantageous in preserving soil productive capacity and reducing the erosion of native forage species. Ustunsoy (1972) reports livestock population estimates for the year 2000 prepared in 1966 which predict 24.7 million head of cattle, more than double the present total but predicts 7 million fewer sheep. These probably erroneous estimates suggest that early livestock production targets were not fulfilled, and that underachievement of this magnitude can only realistically be accounted for by inadequate feed resources and the need for more effective economic incentives. Ustunsoy (1972) postulated that compound feed consumption would be more than 6 million tonnes and Sahin and Ozugur (1976) suggested that by 2000 Turkey would be growing more than 4 million ha of forage legume crops. These predictions could be very optimistic as the current hectarage of forage crops is only around 500,000 ha and compound feed production in 1987 was only 3.6 million tonnes (GOT, 1987). However, a fur ther major expansion of the successful fallow replacement policy, and a change from continuous cereal sequences to cereal/forage legume sequences would be very beneficial in maintaining soil fertility and from the substantially increased return from value-added livestock products. Given the example of chickpea and lentil hectarage increases in the last 10-years, this goal is still possible early in the 21st century if sufficient governmental support can be mobilized. Greater chickpea and lentil production also would be desirable to increase exports, but this could be brought about more easily by improved production per unit area (e.g., by earlier planting of disease resistant, machine-harvestable cultivars) than by necessarily expanding the sown area.

What elements of the Turkish experience could suitably be adopted by other countries in the Mediterranean region?

It seems evident that countries seeking to improve staple cereal self-sufficiency should be careful not to cause an imbalance in their policy incentives that may negatively affect one production sector, such as livestock, while encouraging another such as food grains. Such an imbalance may appear to be productive in the short term but its long-term consequences are probably undesirable. As the livestock industry in the Mediterranean region largely produces value-added goods such as meat and wool with considerable export potential, attention to efficient, quality production in this area may strongly compensate for any additional need to import staple cereals.
Any attempt by countries to rapidly stimulate their agricultural development without due attention to appropriate crop rotations and attempts to reduce the risks of soil degradation and erosion almost certainly will result in a long-term worsening of their current position. The very rapid impact of mechanization on Turkish agriculture in the 1950s had both positive and negative effects. In areas where animal traction is still predominant, the likelihood of long-term degradation of soil resources as a factor in agricultural development should be considered carefully by government development agencies prior to making substantial interventions into current dryland production systems. The seriously negative impact of this aspect of development, for example in the dry steppe lands of Syria, is only now being fully appreciated (Jaubert, 1983).
The fallow replacement policy with chickpea and lentil crops practiced by the Turkish Government in the late 1970s and 1980s has been successful in that it has led to a major world export market and welcome hard currency earning potential. This policy was driven by price guarantees and strategic agricultural research closely linked to effective agricultural extension, which demonstrated an option to change a traditional system for the better. The rate of return on this research and extension investment must have been very large (Guler, 1990). However, this has not been effectively documented. Had it been so, agricultural research expenditure by the Government

of Turkey might not have been as severely curtailed in the early 1990s as it has been, particularly in the vital category of operational funds expenditure. This threatens, for example, rapid improvement in food legume production per unit area which could be realized very quickly with further commitments to intensive research and extension commitment. Private sector research efforts have not been forthcoming as a substitute for reduced government effort. All governments in the Mediterranean region should encourage adequate impact assessment studies in parallel with all research efforts. This would help to identify more clearly those technological changes for which it would be economically rational for the government and private sector to arrange preferential investment.

One key to the success of wheat production in Turkey has been the development and maintenance of a substantial cadre of trained scientists capable of feeding from, and interacting with, the major reservoir of germplasm and technological information which is available globally for wheat production technologies (21 staff from the Ministry of Agriculture and Rural Affairs were active wheat breeders or pathologists in 1990 (CIMMYT, 1990) and additionally, there was a substantial number of cereal agronomists). In direct contrast, the food legume, pasture, forage and livestock sectors are much more poorly served in manpower, available information and sources of improved genetic stock adapted to the diverse but often hostile environments of the Mediterranean region. Governments should not expect major impacts from research if their scientific cadre is smaller than the critical threshold, and if this cadre is cut off from the mainstream of world research effort either by language problems, lack of communication materials or international transport barriers.

Conclusions

In the last 40 years the outcome of Turkish agricultural development has been very substantial and profitable. However, it has shown imbalance between production sectors and between the equitable development of geographic regions within the country. Additionally, development often has occurred at the cost of increased degradation of the natural resource base, which may imply the unsustainability of the production of the current system in the long-term. In contrast, the successful impact of the fallow replacement policy could be further expanded in the future, in the interests of reducing risks of degradation of existing land resources and encouraging greater livestock offtake. Additional targeted research and adjustment of policy incentives are required to create a more regionally balanced and sustainable program for the future.

Lessons appropriate to the other countries of the Mediterannean region wishing to encourage their agricultural development have been drawn from this analysis. This may permit them to feed their growing populations in the future equitably, in a sustainable fashion and without incurring the production problems, while yet experiencing the production successes enjoyed by the Turkish nation in the last 40 years. ●

References

Aresvik, O., 1975. *The Agricultural Development of Turkey*. Praeger, New York, USA.

Aksoy, S., Erkus, A. and Winkler, W., 1980. *Das Turkische Agrarrecht im Vergleich mit der Agrargesetzgebung Einiger Europaischer Lander*. C. Heymanns Verlag KG, Koln, Germany.

Akyildez, A. R., 1972. Ruminant nutrition, feed resources and their improvement in Turkey. In: *Development of Feed Resources and Improvement of Animal Feeding Methods in the CENTO Region Countries*. TPI, London, UK.

Aydeniz, A., 1975. Toprak Amenajmanina Giris 1. *Ankara Universitesi Ziraat Fakultesi Yayinlari 571*, Ankara, Turkey.

Balaban, A., 1972. Land and water resource development for crop production in Turkey. In: *Proceedings of the CENTO Seminar on Agricultural Aspects of Arid and Semi-arid Zones, Tebran, Iran 19-23, Sept, 1971*. CENTO, Ankara, Turkey.

Bakir, O., 1972. Range management in Turkey. In: *Development of Feed Resources and Improvement of Animal Feeding Methods in the CENTO Region Countries*. TPI, London, UK.

Bromley, D.W. and Cernea, M.M., 1989. The Management of Common Property Natural Resources: Some Conceptual and Operational Fallacies. *World Bank Discussion Paper 57*, The World Bank, Washington, USA.

Cayir-Mer'a ve Zootekni Arastirma Enstitusu, 1973a. Research Projects on the Possibilities of Using Summer Fallow Lands for Producing Forage Crops in Turkey. *Ankara Cayir-Mer'a ve Zootekni Arastirma Enstitusu Yayinlari 28*, Ankara, Turkey.

Cayir-Mer'a ve Zootekni Arastirma Enstitusu, 1973b. Research Projects on the Possibilities of Developing Rangelands and Forage Crop Production. *Ankara Cayir-Mer'a ve Zootekni Arastirma Enstitusu Yayinlari 33*, Ankara, Turkey.

CIMMYT, 1989. *1987-88 CIMMYT World Wheat Facts and Trends. The Wheat Revolution Revisited: Recent Trends and Future Challenges*. CIMMYT, Mexico City, Mexico.

CIMMYT, 1990. *Review of the CIMMYT International Winter/Facultative Wheat Program and Its Relationship with National Agricultural Research Systems (NARSs), June 4-15, 1990*. CIMMYT, Mexico City, Mexico.

Demirlicakmak, A., 1972. Wheat production problems and potentials on drylands. In: *Proceedings of the CENTO Seminar on Agricultural Aspects of Arid and Semi-arid Zones, Tebran, Iran, 19-23 Sept, 1971*. CENTO, Ankara, Turkey.

Durutan, N., Yilmaz, B. and Kiziltan, M., 1988. Small grains and food legumes production improvement in Turkey. In: J. P. Srivastava, M.C. Saxena, S. Varma and M. Tahir, *Winter Cereals and Food Legumes in Mountainous Areas*, ICARDA Research Report 136 En, ICARDA, Aleppo, Syria.

Durutan, N., Meyveci, K., Karaca, M., Avci, M. and Eyuboglu, H., 1990. Annual cropping under dryland conditions in Turkey: a case study. In: A.E. Osman, M. H. Ibrahim and M. A. Jones, *The Role of Legumes in the Farming Systems of the Mediterranean Areas*, Kluwer, Dordrecht, Netherlands.

Elci, S., 1972. Arid zone problems in Turkey. In: *Proceedings of the CENTO Seminar on Agricultural Aspects of Arid and Semi-arid Zones, Tebran, Iran, 19-23 Sept, 1971*. CENTO, Ankara, Turkey.

FAO, 1959. *FAO Mediterranean Development Project - Turkey Country Report*. FAO 59/8/6251. FAO, Rome, Italy.

Government of Turkey, Central Statistical Office, 1954. Agricultural Structure and Production 1946-53. GOT publication No. 351, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1968a. *Agricultural Structure and Production 1967*. GOT publication No. 539, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1968b. *The Summary of Agricultural Statistics, 1967*. GOT publication No. 557, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1973. *Statistical Yearbook of Turkey 1971*. GOT publication No. 670, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1979. *Agricultural Structure and Production 1975-77*. GOT publication No. 882, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1981. *Statistical Yearbook of Turkey 1981*. GOT publication No. 960, Ankara, Turkey.

Government of Turkey, State Planning Organization, 1984. *Livestock Products Development Study Vol. 9 - Animal Feed Resources*. Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1989. *Agricultural Structure and Production 1987*. GOT publication No. 1376, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1990a. *The Summary of Agricultural Statistics, 1988*. GOT publication No. 1406, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1990b. *Statistical Yearbook of Turkey 1989*. GOT publication No. 1405, Ankara, Turkey.

Government of Turkey, State Institute for Statistics, 1991. *The Summary of Agricultural Statistics, 1989*. GOT publication No. 1474, Ankara, Turkey.

Guler, M. and Karaca, M., 1988. Agroclimatological criteria for determining the boundaries of fallow practice. In: J. P. Srivastava, M.C. Saxena, S. Varma and M. Tahir, *Winter Cereals and Food Legumes in Mountainous Areas*, ICARDA Research Report 136 En, ICARDA, Aleppo, Syria.

Guler, M., 1990. The role of legumes in the farming systems of Turkey. In: A.E. Osman, M. H. Ibrahim and M. A. Jones, *The Role of Legumes in the Farming Systems of the Mediterranean Areas*, Kluwer, Dordrecht, Netherlands.

Jaubert, R., 1983. *Sedentary Agriculture in the Drier Areas of Syria: Development Problems and Implications for ICARDA*. Farming Systems Program Research Report, ICARDA, Aleppo, Syria.

Mann, C. K., 1980. The effects of government policy on income distribution: A case study of wheat production in Turkey. In: E. Ozbudun and A. Ulusan, *Political Economy of Income Distribution in Turkey*, Holmes and Meier Publishers Inc., New York, USA.

Munzur, M., 1989. *Fodder Development and Rangeland Rehabilitation and Improvement*. TARM Genel Yayin No. 1989/3, TARM Matbaasi, Ankara, Turkey.

Oram, P. and Belaid, A., 1990. *Legumes in Farming Systems*. ICARDA/IFPRI Research Report 160 En, ICARDA, Aleppo, Syria.

Rhodes, L. H., 1969. The economic impact of the wheat program and livestock programs with possible alternative government policies in Turkey. In: *Research, Productivity and Economic Reports on Agriculture in Turkey*. USAID, Ankara, Turkey.

Sahin, D. M. and Ozugur, E., 1976. *Turkiye'de Cayir-Mer'a Yem Bitkilerinin Durumu ve 1952-1975 Yillari Arasinda Yapilan Calismalar*. Ankara Cayir-Mer'a ve Zootekni Arastirma Enstitusu Yayinlari No. 62, Ankara, Turkey.

UNDP, 1988. *Pilot Project for Production Improvement of Eastern Anatolian Pastures, Meadows and Forage Crops*. UNDP-FAO Document No. TUR/87/052/C/01/12. FAO, Rome, Italy

Uslu, S., 1972. Erosion control and vegetative cover under dryland conditions in Turkey. In: *Proceedings of the CENTO seminar on Agricultural Aspects of Arid and Semi-arid Zones Tebran, Iran 19-23 Sept, 1971*. CENTO, Ankara, Turkey.

Ustunsoy, O., 1972. The compound feed industry in Turkey. In: *Development of Feed Resources and Improvement of Animal Feeding Methods in the CENTO Region Countries*. TPI, London, UK.

Yesilsoy, M.S., 1988. Agronomic and socioeconomic impacts of wheat production in Turkey. In: P.W. Unger, T.V. Sneed, W.R. Jordan and R. Jensen, *Challenges in Dryland Agriculture: A Global Perspective*, Texas Experimental Station, Bushland, Texas, USA.

Acknowledgements

The author would like to acknowledge the International Center for Agricultural Research in the Dry Areas (ICARDA) under whose auspices the research and initial drafts of this paper were prepared.