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WEED PROBLEMS OF TURKEY

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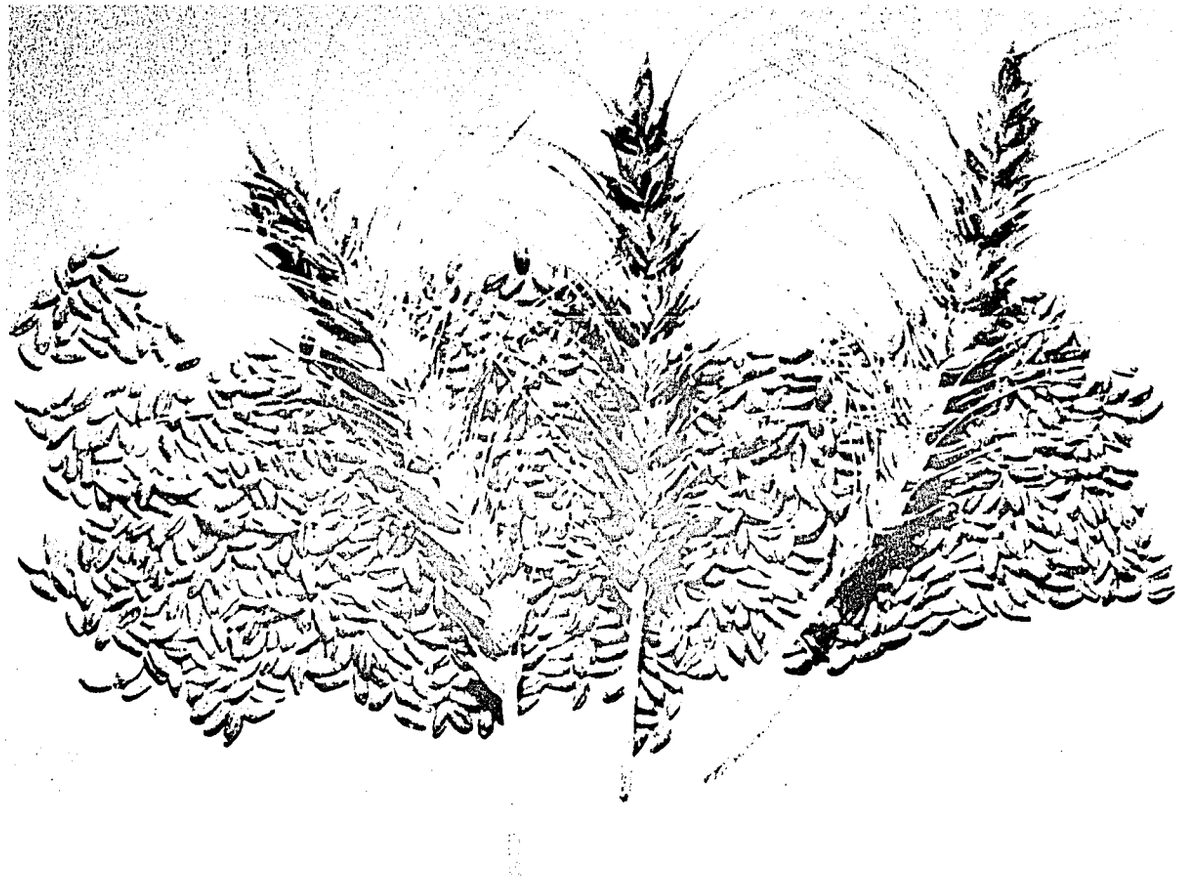


PREFACE

This report summarizes pesticide registration, regulation, current herbicide usage, activities of the pesticide industry and weed distribution in Turkey. The material presented is intended to be useful information for all persons interested in Turkey's weed problems as well as the current and future steps toward solving them.

My deep gratitude goes to Dr. W. R. Furtick for helping me to study the issue in Turkey. Thanks are also extended to Dr. J. R. Cowan, Dr. H. H. Hepworth, Dr. N. Göksel, Mr. Cevdet Sevintuna, and USAID in Turkey for their contributions to the preparation of this report.

Ercan GÜneyli
Corvallis, Oregon
April 1970

CONTENTS

TURKEY'S AGRICULTURAL ECONOMY IN BRIEF

The land area of Turkey is 300,000 square miles, nearly as large as the states of Texas and Louisiana combined.

Turkey is made up of the high Anatolian plateau and low elevation coastal belts. Mean annual precipitation is 11 inches in parts of the interior, but most of the coastlands receive over 20 inches. Central plateau mean temperatures range from 30°F in winter to 75°F in summer. The Mediterranean Coast has mean temperatures of 50°F in winter and 80°F in summer.

While forests cover about 20 percent of the country (1969), agricultural land makes up approximately 70 percent of the total area. There are roughly 63 million acres of arable land (1963). About 50 percent of the arable land is under wheat production [8]. An estimated 5 million acres are irrigated. A grain and fallow rotation is common over a large part of the country.

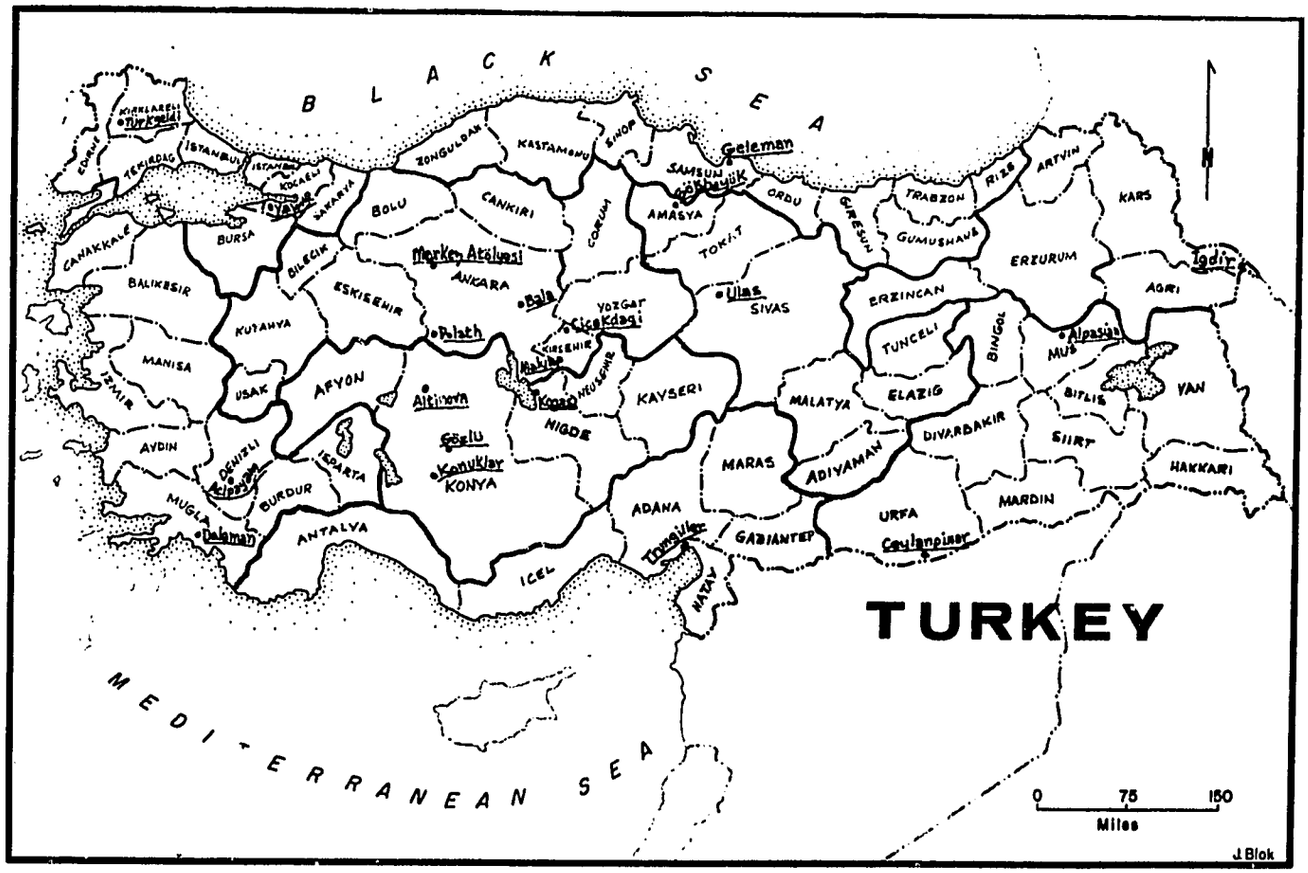
Pastures are normally held by the community and are badly over-grazed. Turkish agriculture is laregly dependent on primitive farming implements, animal draft power, and much hard labor. Although fertilizer usage has increased by a thousand fold in the last decade, Turkish farmers still use relatively little fertilizer; animal manure is commonly burned for fuel in continental Turkey.

Low average farm income permits few modern improvements. Over 60 percent of the farm families own less than 12 acres of cropland; nearly 85 percent own less than 25 acres.

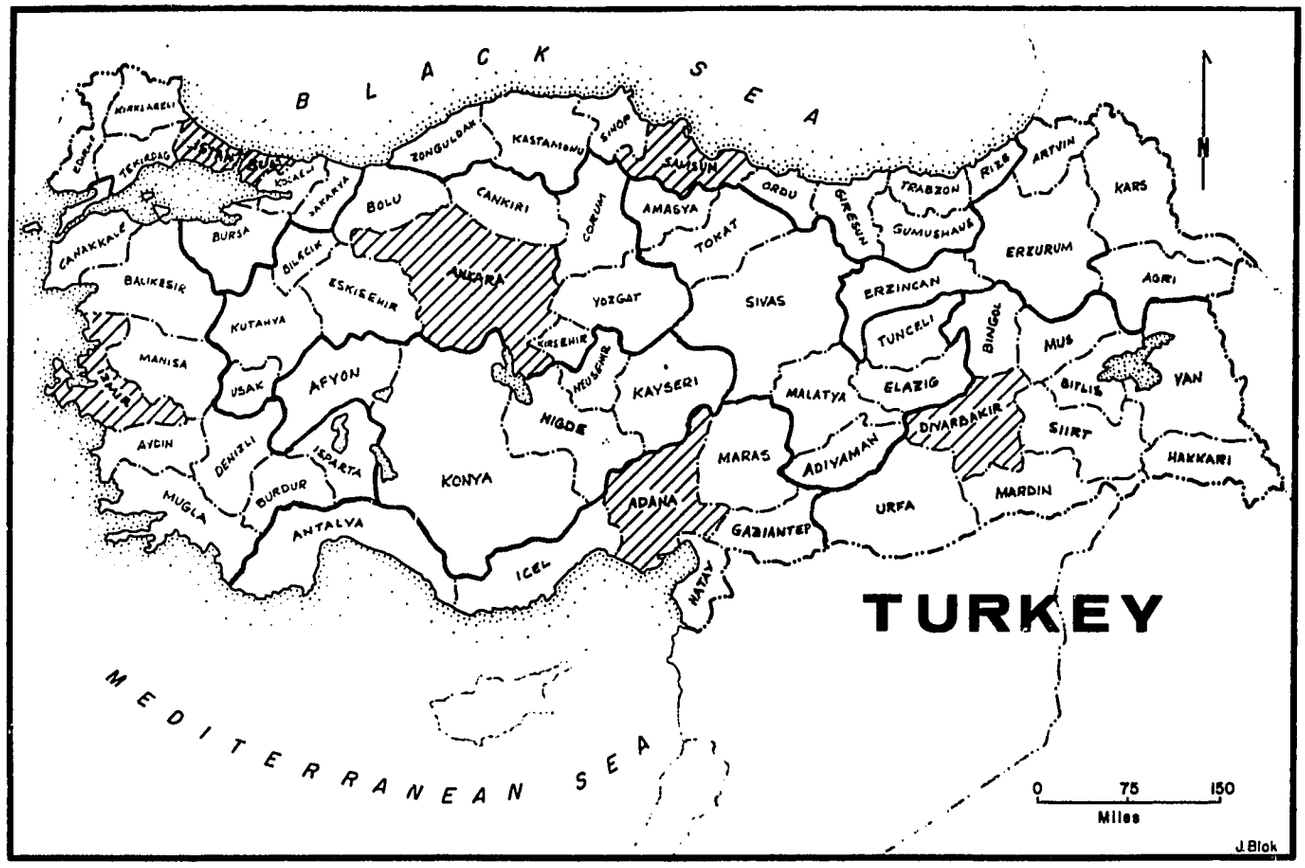
The country has 20 state-owned crop production farms - combining more than 850,000 acres - that are modern and fully mechanized (map 1). However, less than 20 percent of the total arable land in Turkey was machine cultivated in 1968.

Turkey is basically self-sufficient in foods; fats and grains are imported in drought years. The national level of food consumption - averaging nearly 2,600 calories per capita daily in the 3-year period, 1959-1961 - is one of the highest in Asia [6]. However, the high rate of population increase (2.8 percent) necessitates an increase in the total food production.

Turkey exports tobacco, cotton, fruits, nuts, livestock, and sugar. Total value in 1968 was over $600 million. Slightly less than 20 percent of the agricultural exports have gone to eastern Europe and the Soviet Bloc. The United States purchased about 16 percent, by value, of Turkish agricultural exports in 1963. In the world market Turkey competes with the U.S. in durum wheat, barley, cotton, tobacco, nuts, dried fruits and, in some years, citrus fruits.



Map 1. State farms of Turkey (underlined - province names in capitals).



Map 2. Weed research institutions in Turkey.

WEEDS ASSOCIATED WITH THE MAJOR TURKISH CROPS

WHEAT

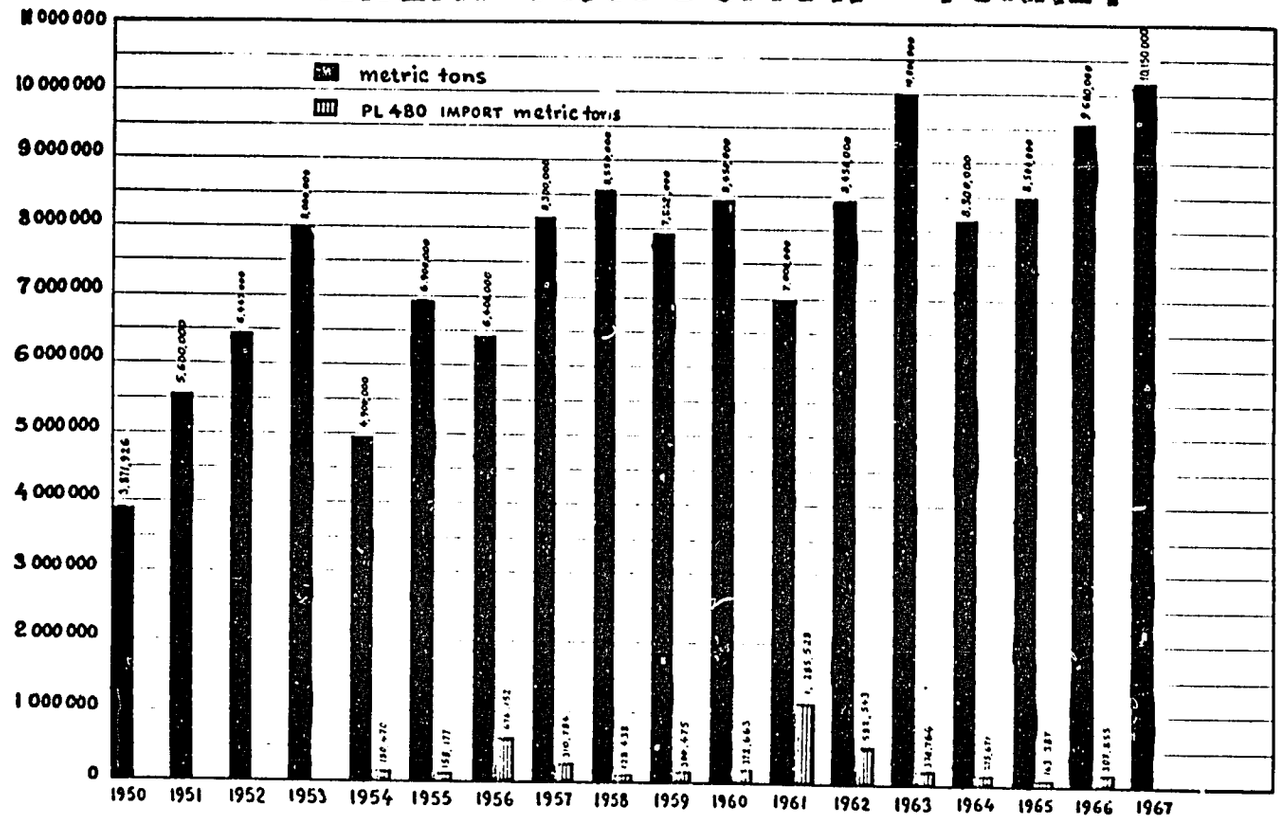
Turkey has 34 million acres planted to wheat. An estimated 20 million acres of this area requires weed control. Only 1.6 million acres are currently being treated with herbicides; projections for 1973 are that about 6 million acres will be treated. Most of the herbicide application now occurs on the state farms and on the land of contracted farmers. It is estimated that wheat yield can be increased by 27 percent - a net return of 2.7 million tons of wheat valued at about $240 million - if herbicides are used.

Total yield of wheat and yield per hectare have both increased in the last decade (figures 1 and 2). But there is increased need for research, teaching and extension in the contemporary methods of planting, weed control and fertilizer application methods for wheat.

One of the major weeds found in wheat growing areas is *Cirsium arvense* L. (Scop.) (Canada thistle). Its density increases in the eastern part of Turkey (map 3). Canada thistle blooms in June in the higher elevations. Mature seeds are scattered in the valleys by the wind. It is common to see the thistle seeds parachuting from higher to lower elevations. Most Turkish farmers simply do not have the mechanical or chemical tools for controlling this noxious weed.

Approximately one third of the wheat planting area

WHEAT PRODUCTION - TURKEY



WHEAT YIELDS PER HECTARE

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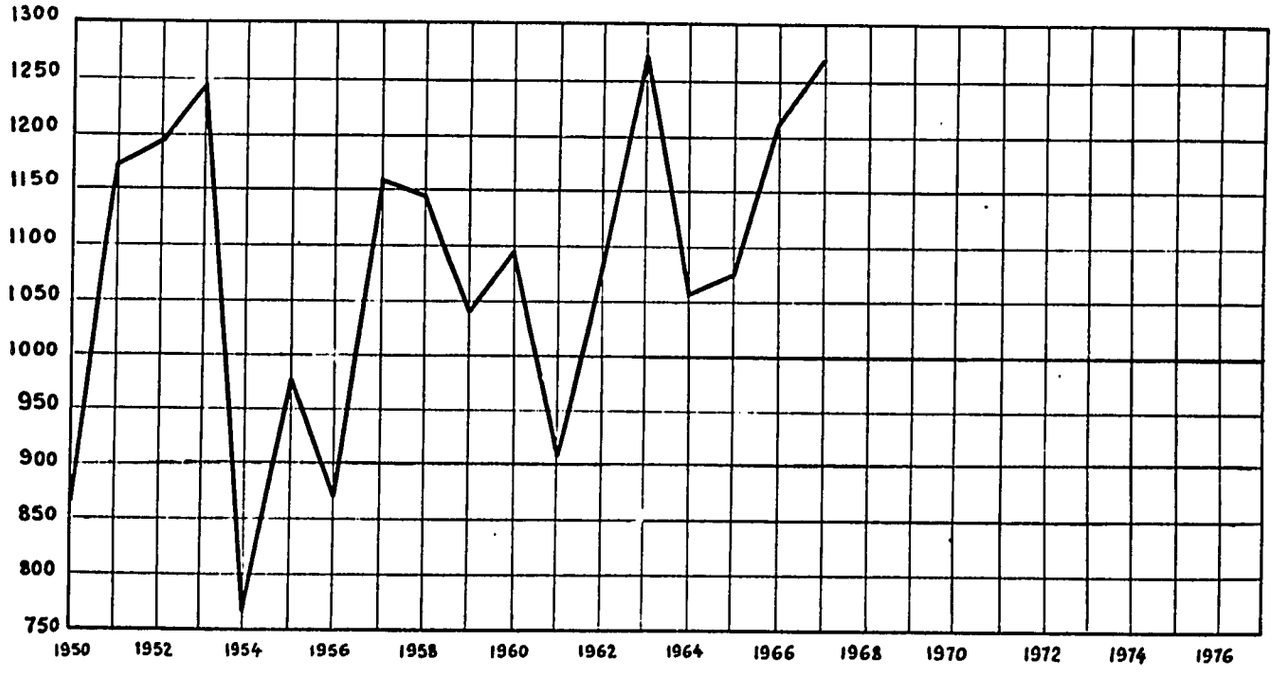

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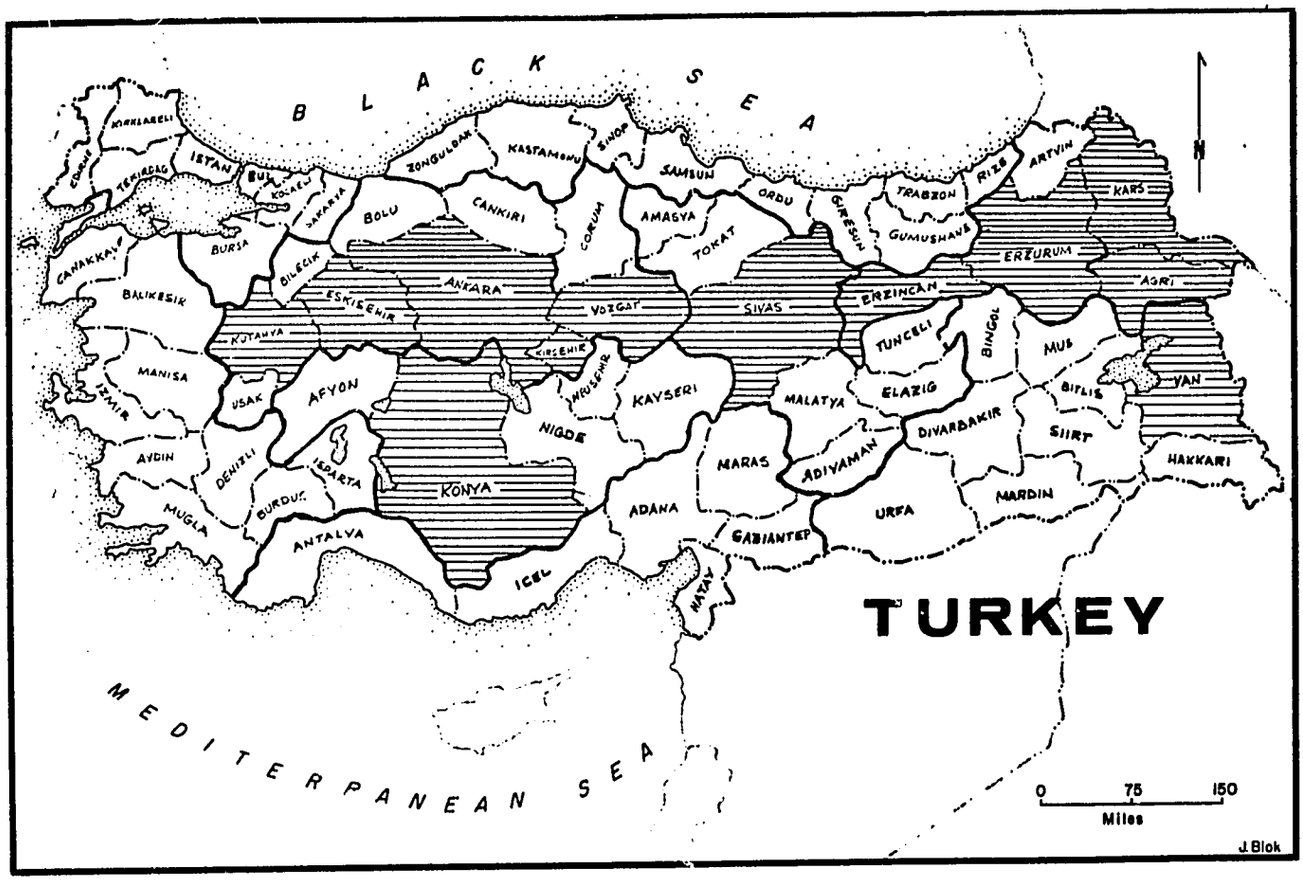


Map 3. Distribution of Cirsium arvense in Turkey.

is left for fallow. Very few farmers have the means for performing mechanical cultivation on fallow land. In the Anatolian plateau and in the Mediterranean region many farmers practice summer tillage. It is hard to estimate the quality of weed control achieved and how much benefit is derived from these tillage practices. Weeds such as *Cirsium*, *Onopordium*, *Carduus*, *Convolvulus*, *Brassica*, and *Centaurea* species are abundant on the fallow land.

Moisture conservation is the main reason for fallow in Turkey; but the weeds present on fallow land consume moisture and reduce the benefit of fallow. Most farmers using mechanical weed control on fallow land get the job done too late. Improper timing of tillage and type of tillage implements are big factors causing moisture losses from the soil.

A common soil tillage practice is to use the moldboard plow in the fall after harvest. The soil is turned over about 18 to 20 inches deep. This type of soil tillage practice causes tremendous moisture losses from the soil.

Turkish state farms have developed a new system. Instead of regular moldboard plowing in the fall the soil is chiseled in the spring. Sweeps - starting in early March -

and then rod-weeders (4 - 5 inches the first time, 3 inches the second time) are used according to the requirements during the season. But this type of practice has also increased cheatgrass populations.

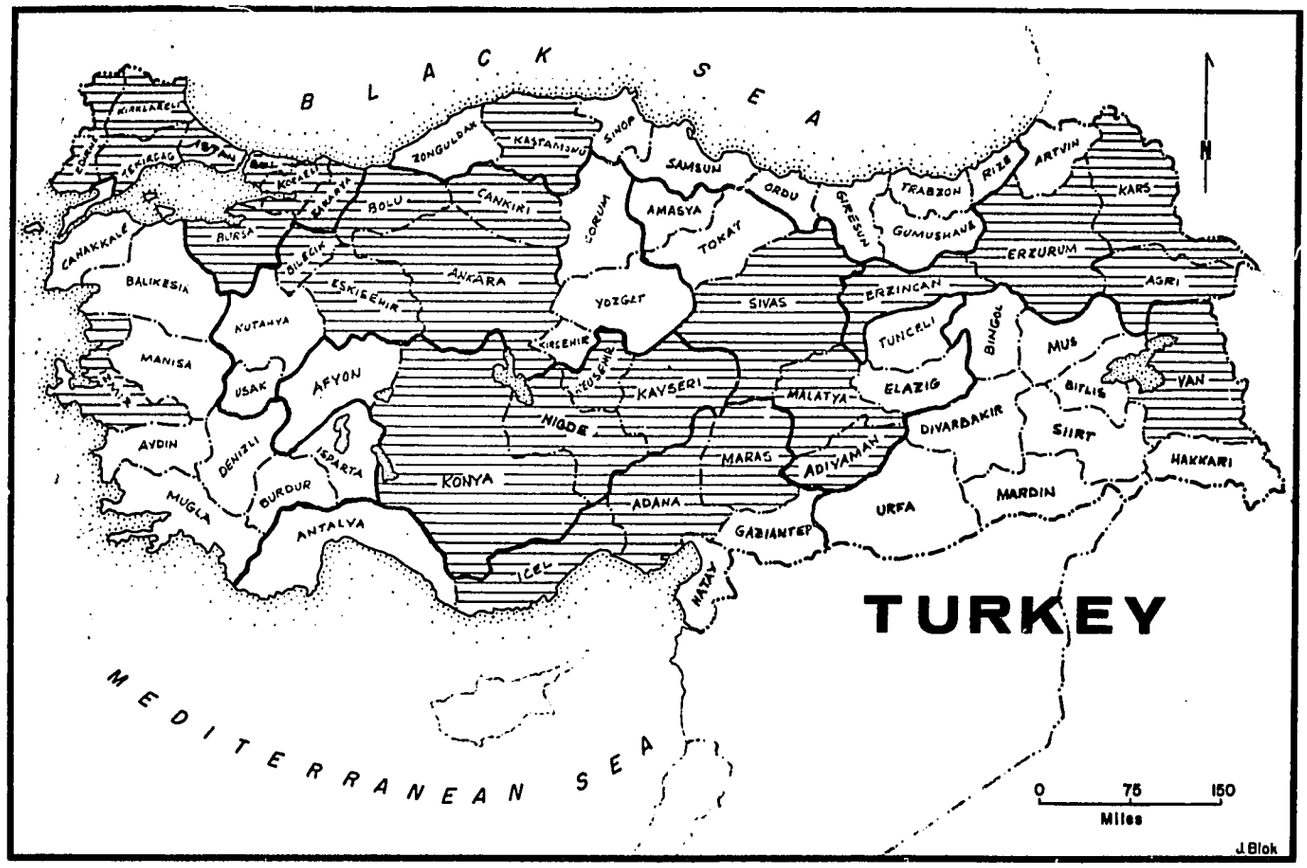
State farms have been using phenoxy herbicides for over a decade. There is evidence that, as a result of the new tillage system and application of herbicides, some ecological shifts in the weed distribution, density and abundance have occurred. At the present time grassy weeds are more of a problem than broadleaf weeds on the state farms. Weeds such as *Aegilops cylindrica* L., *Avena fatua* L., *Bromus tectorum* L. (map 4) are becoming increasingly serious problems. The changes have also resulted in a modified cultivation system: no fall chiseling, a light spring chiseling and then sweeps and rod-weeders are used around the year as required. Whether the chiseling is done at the right time and depth is a question.

Boreava orientalis infestation in a wheat field in Ankara Province, Turkey.

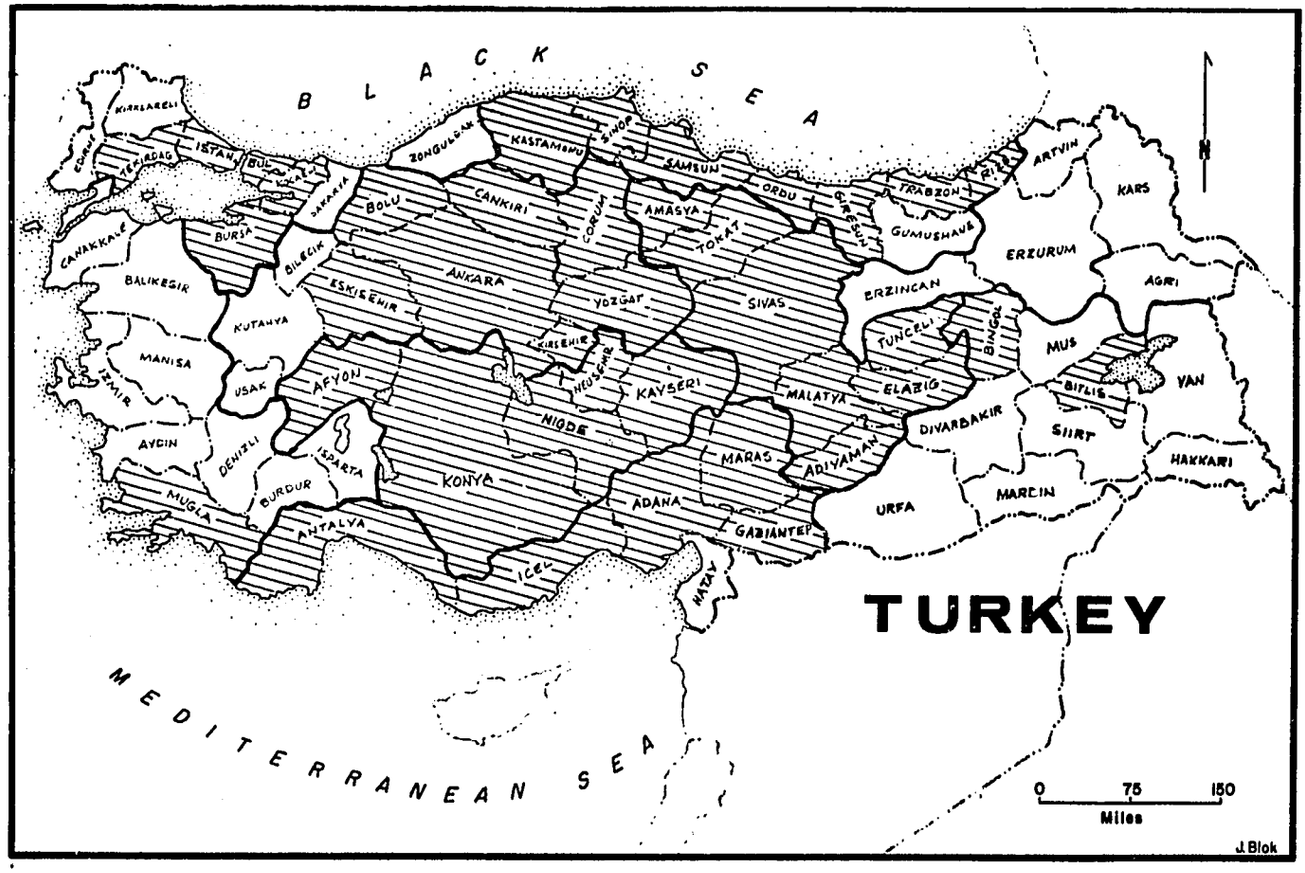
Another problem associated with wheat is the increased weed problem due to the use of fertilizers. Heavy rains and fertilizer applications have increased weed problems in wheat fields in 1969. The Mexican wheat program has raised serious questions regarding the relationship of fertilizer and weeds. An integrated weed control practice, such as combined mechanical and chemical weed control, helps to control this problem. However, most Turkish farmers are not as yet geared up for using these methods for weed control.

There also have been some reports on the susceptibility of Mexican wheat to phenoxy herbicides. It is believed that herbicide susceptibility is more likely to be related to the planting time rather than varietal differences.

Boreava orientalis Jaub. (yellow weed) is mainly



Map 4. Distribution of Bromus tectorum in Turkey. Revised from Göksel (1).



Map 5. Distribution of Boreava orientalis in Turkey. From Göksel (1).

found in Central Anatolia (map 5). Yellow weed is a crucifer, which is also found in barley and oats, and can easily be controlled by applications of 2,4-D esters [2].

Convolvulus arvense L. (Scop.) (field bindweed) is found in almost every crop land (map 6). Dense patterns of field bindweed can be seen on the fallow land. *Convolvulus galaticus* L. is also a very common species of bindweed found in cotton, sugar beets, and sunflowers.

Centaurea repens L., *Centaurea depressa* L., and *Centaurea solstitialis* L. are all common weeds appearing in the wheat growing areas of Turkey (map 7). *Allium vineale* L., (wild garlic) *Rumex crispus* L. (curly dock), *Sinapis arvensis* L. (charlock), *Sonchus arvensis* L. (perennial sowthistle), *Chenopodium album* L. (common lambsquarters), *Polygonum lapotifolium* L. and *Alhagi camelorum* Fisch. (camelthorn) are also commonly found in cereals and fallow land.

Herbicides used for weed control in wheat are mainly 2,4-D, MCPA and 2,4,5-T. Studies are also under way with linuron, monuron and diuron. Herbicide usage on state and private farms is shown in Table 1.

Adana, Igdir and Agean, Turkey are the main cotton producing regions. Cotton has recently become the major export [7] replacing tobacco. The production of cotton has increased remarkably among all crops grown in Turkey. Cotton growers are also well mechanized and, in general, perform pest control practices, except chemical weed control. This is partly due to the fact that no concentrated effort has been launched to demonstrate how to use chemicals for weed control in cotton. Studies on weed control in cotton are at the initiation stage.

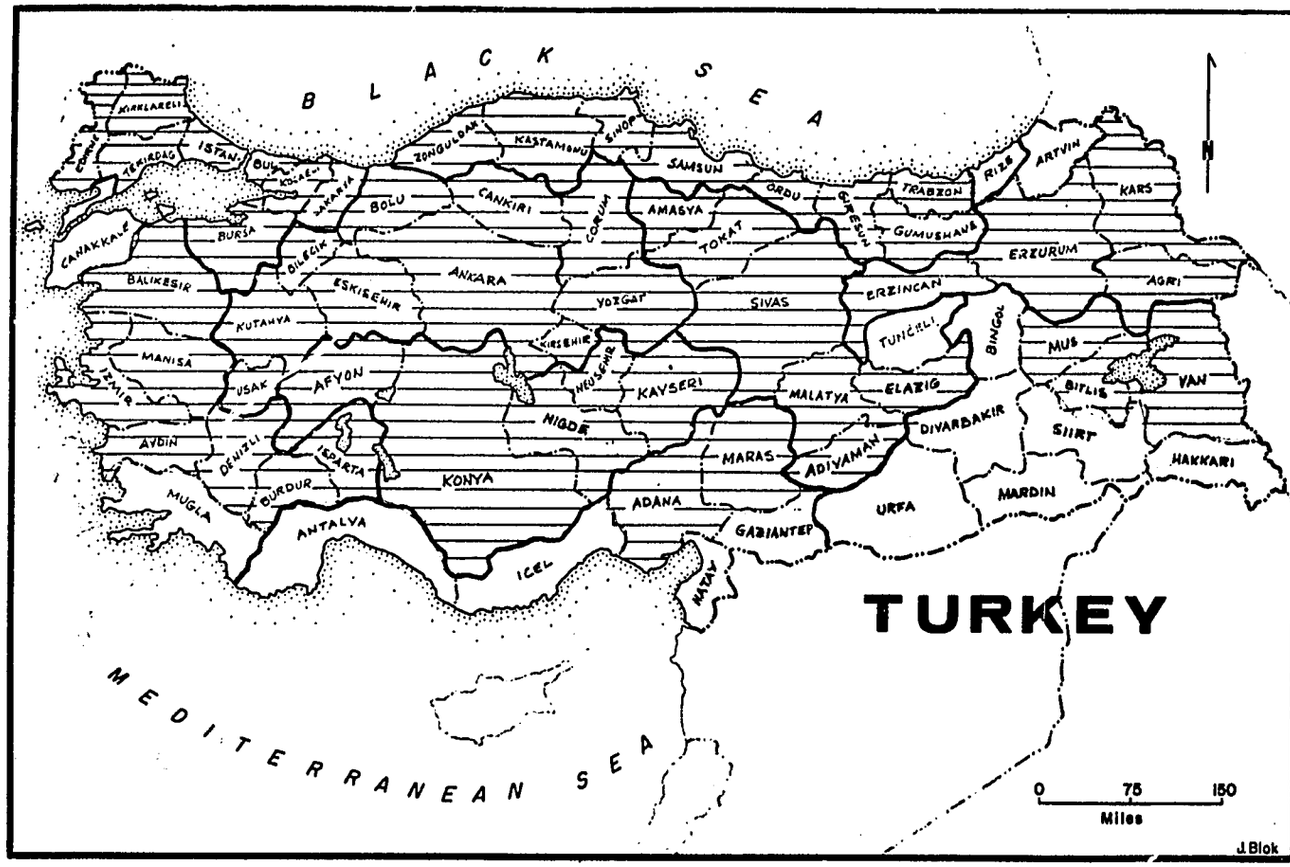
Norea (herban) and trifluralin (Treflan) are promising herbicides for cotton. In the first year of registration for Treflan (1969) 10 tons were applied in Turkey. It is believed that this herbicide will find a major usage in cotton provided chemical rotation of Treflan in cotton be studied in relation to crop rotation. Adana farmers usually have two crops in a season. The general pattern is wheat and cotton. Administrative and extension people should be very careful in recommending Treflan before thoroughly studying its dissipation in the Adana Valley.

Sorgum halepense L. (johnsongrass) is a major problem in cotton. Orchards, and pastures in the warm regions are also infested by this weed. Johnsongrass is called "Gelis" in Turkish which means "something that comes with water." This has been found to be very true. Johnsongrass, as well as *Setaria* spp., grows extensively along the irrigation canals. After seed maturation, plants shatter their seeds into

TABLE 1

HERBICIDE USAGE ON STATE AND PRIVATE FARMS IN TURKEY

Years	Total Area Sprayed (acres)	
	State	Private
1965	161,490	347,882
1966	203,475	479,717
1967	357,390	573,467
1968	535,955	685,480



Map 6. Distribution of Convolvulus arvense in Turkey.

the irrigation water and the seeds are floated to the fields.

Setaria verticillata L. (Beauv.) is a very serious and undesirable weed in cotton. Its seeds stick into the cotton fibers and depreciate the quality of cotton.

Prosopis stephaniana spr. (wild mesquite) is a deep-rooted perennial which is mainly found in the Adana Valley. It is very hard to control mesquite by mechanical means.

Amaranthus retroflexus L., *Amaranthus viridis* L., *Amaranthus caudatus* L., *Cynodon dactylon* L., *Echinochloa crusgalli* L. (Beauv.), *Tribulus terrestris* L., and *Convolvulus* spp. are also commonly found in cotton fields.

SUGAR BEETS

The production of sugar has been a triumph for Turkey. The country has moved from an importer to an exporter in the last decade. This is due to improved methods of both raising, processing sugar beets, and increased total sugar beet planting area. Presently there is no chemical weed control in sugar beets.

Cuscuta spp. are troublesome weeds of sugar beets. Dodder infestations are heavier in the warmer regions of Turkey (map 9). Dodder also feeds on weeds such as yellowstar thistle. Control of this weed requires extensive study

of the host-parasite relationships and phenology of dodder. Dodder is also a serious problem in alfalfa fields. Redroot pigweed, smartweed, field bindweed, lambsquarters, purslane, camelthorn, burdock, and foxtail species are commonly found in sugar beet fields.

PASTURE AND MEADOWS

Pasture lands of Turkey are a common grazing ground. Due to uncontrolled grazing, range and pasture land have been depleted. Selective grazing by livestock has caused a tremendous increase in the weed population, frequency and distribution. There are many pasture weed species that are poisonous to livestock. At the present time, no attention is given to range and pasture weed control.

Hypericum spp., a weed that causes livestock losses due to poisoning, has its main distribution in southeastern Turkey.

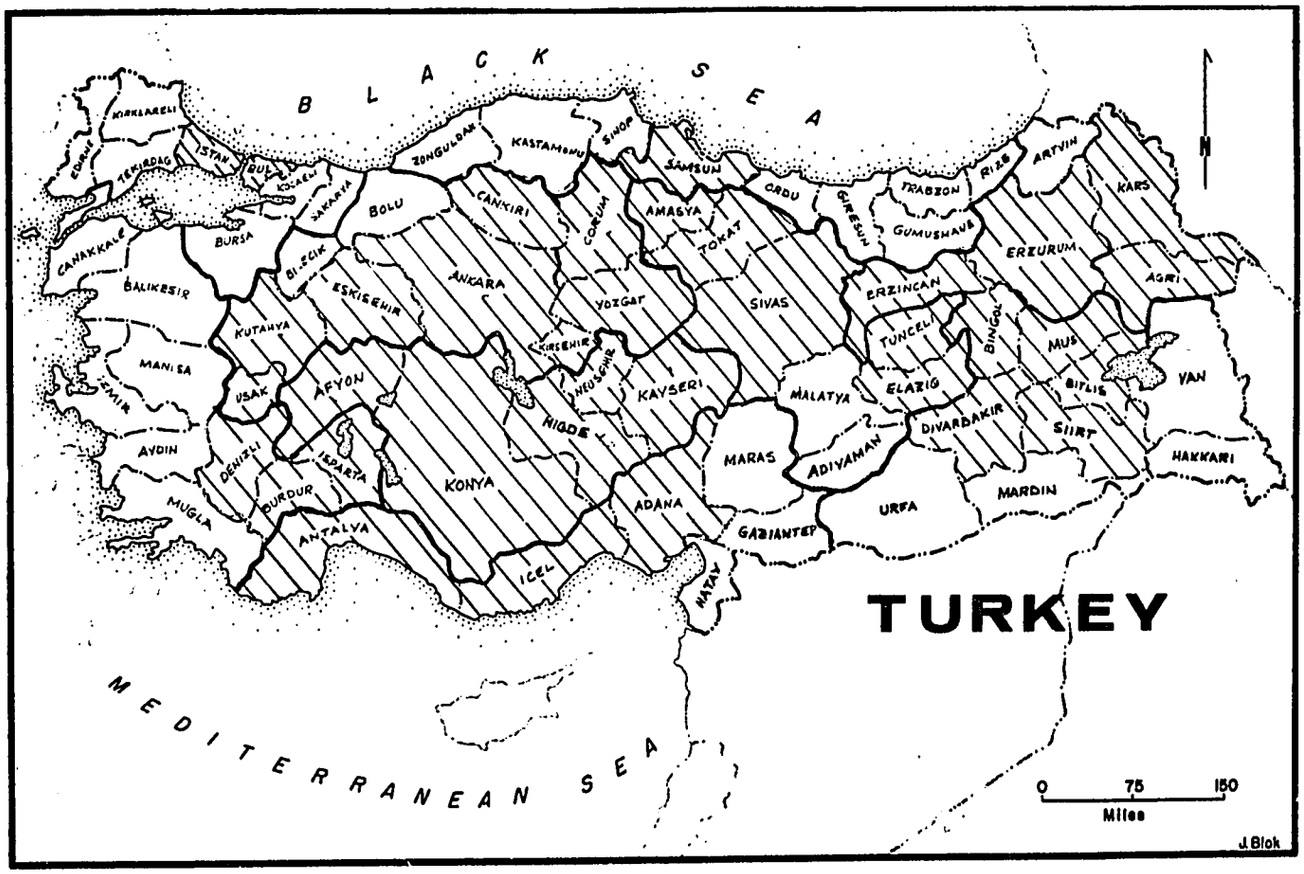
There are several leguminous weeds prevalent including at least six known species of *Astralagus*. Two species of wild licorice are major concerns for farmers. Wild licorice, *Glycyrrhiza glabra* L., occupies millions of acres of land in eastern Turkey (map 10).

Cephalaria syriaca L. is mainly found in southeastern Turkey. Nevertheless, this particular weed has been introduced to the Anatolian plateau by crop and pasture seeds.

Carduus, *Cirsium*, *Onopordium*, *Phragmites*, and *Conium* are additional species commonly found in the pastures and meadows of Turkey.

RICE

Rice plantations are mainly in southern and northern Turkey. Adana, Ankara, Kastamonu and Urfa provinces are the main rice-producing areas of Turkey. *Cyperus esculentum* L., *Pospalum* spp. and barnyardgrass are the common weeds of rice fields. Presently there is no



Map 7. Distribution of Centaurea repens in Turkey. Revised from Göksel (1).

chemical weed control in rice fields.

Ordram has been tested for weed control in rice by Tarsus Research Institute. But insufficient data makes it hard to estimate the performance of this herbicide in rice fields.

FORESTRY

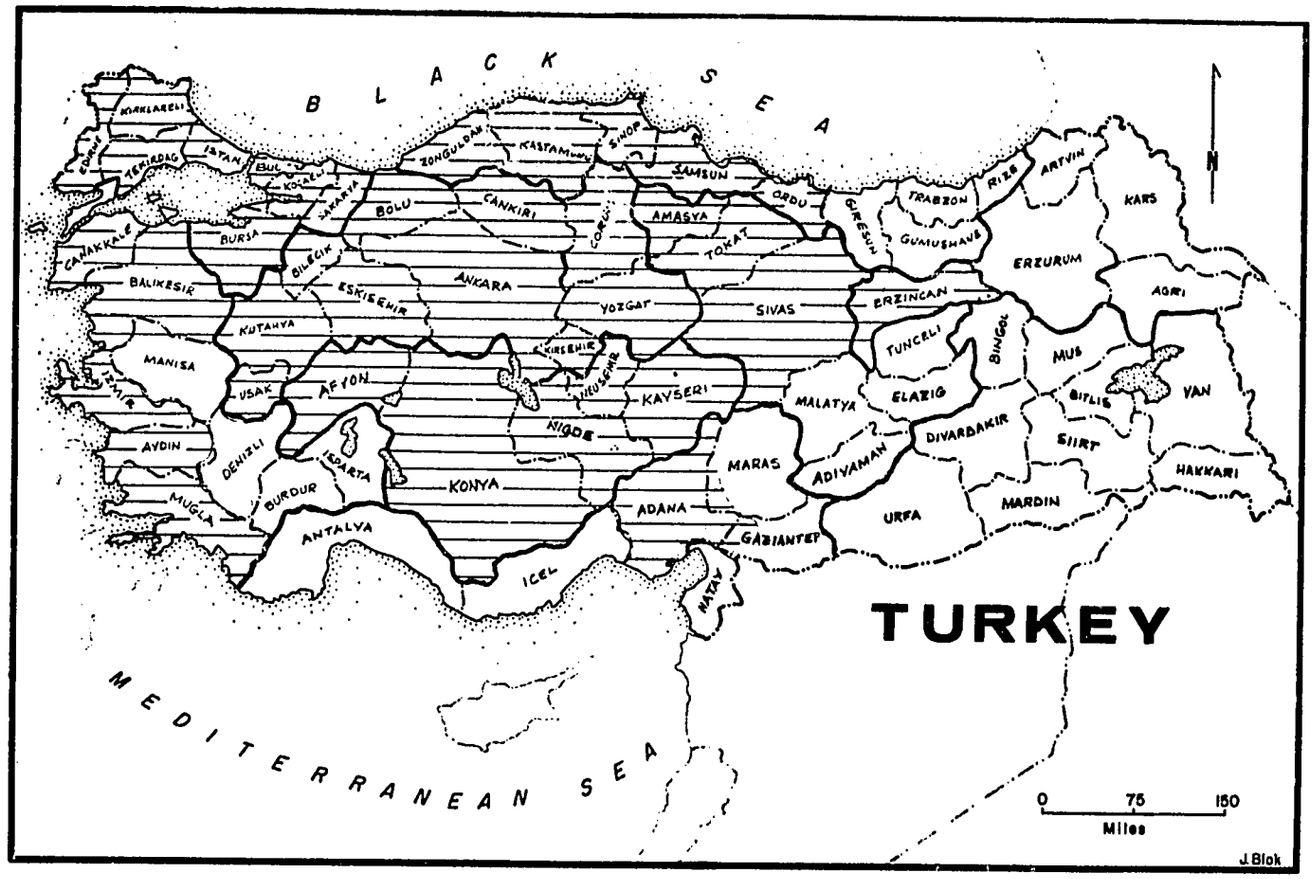
Approximately 20 percent of Turkey is forested. The following tree species are common in the forests of Turkey:

EVERGREEN	Percent
Pinus nigra var. Pallasiana	20.0
Pinus silverstris	9.5
Pinus brutia	9.0
Abies nordmanniana	5.0
Picea spp.	2.0
Cedrus libani	1.0
Juniperus exelsa, *Juniperus foeditissima*, *Pinus pinea*, *Taxus baccata*, *Cupressus horizontalis*	3.7
	50.2
DECIDUOUS	
Quercus sessiliflora, *Quercus pubescens*, *Quercus cerris*, *Quercus hungarica*, *Quercus coccifera*, *Quercus aegilops*, *Quercus castaneifolia*	22.4
Fagus orrentalis	8.6
Carpious betulus	2.7
Castanea vesca	1.4
Alnus barbata	1.0
Populus spp.	0.8
Tilia tomentosa	0.5
Ulmus spp., *Acer spp.*, *Fraxinus spp.*, *Sorbus spp.*, *Ostrya spp.*	10.6
	48.0
Others	1.8

Vegetation manipulation of forested areas through the use of herbicides is at the primordial stage in Turkey. The Turkish Forest Research Institute at Ankara is very interested in using herbicides as a forest management tool. *Ribeceae* and *Rosaceae* families are presently considered the most prevalent families affecting the development of young trees and seedlings.

Özdemir [3] reported that methylbromide applied in pine plantations increased the seedling development. However, standard solvent was more injurious to pine seedlings than methylbromide. There is increased need to study herbicides in forested areas of Turkey. Herbicides such as 2,4-D, 2,4,5-T, atrazine, cacodylic acid, and dalapon should be tested in areas to control the unwanted trees, brush and herbaceous weeds.

Competition between the forest tree species and



Map 8. Distribution of Sinapis arvensis in Turkey. From Göksel (1).

undesirable tree, brush and weed species for water is severe in the summer during low precipitation periods. In the Pacific Northwest forests of the U.S., seedling and tree development is significantly affected by grasses that compete for water in the summer. Herbicides, such as atrazine and dalapon, eliminate the grassy weed competition.

AQUATIC WEED CONTROL

Aquatic weed control should be of some interest to the Turkish government. The bitter experience of African reservoirs and dams is a constant reminder for Turkey where billions of dollars have also been invested on dam construction.

The quality of water for both human consumption and industry also remains a big challenge for Turkey.

At the present time, there is no alarming situation with aquatic weeds in the water canals. This is due to the fact that most canals are too young to show signs of clogging by aquatic weeds.

REGULATIONS REGARDING PLANT PROTECTION, CHEMICALS AND EQUIPMENT

On December 27, 1958 the Turkish Cabinet of Ministers put into effect the regulations regarding plant protection chemicals and equipment drawn up by the Ministry of Agriculture [5]. The amendment includes three sections:

Section I. Describes raw materials, chemicals, equipment, the forms of raw materials and registration procedures.

Section II. Describes raw materials, chemicals, stipulations governing importations plus chemical plants and factories to be established in Turkey. The same section also describes marketing and sales of raw materials and chemicals.

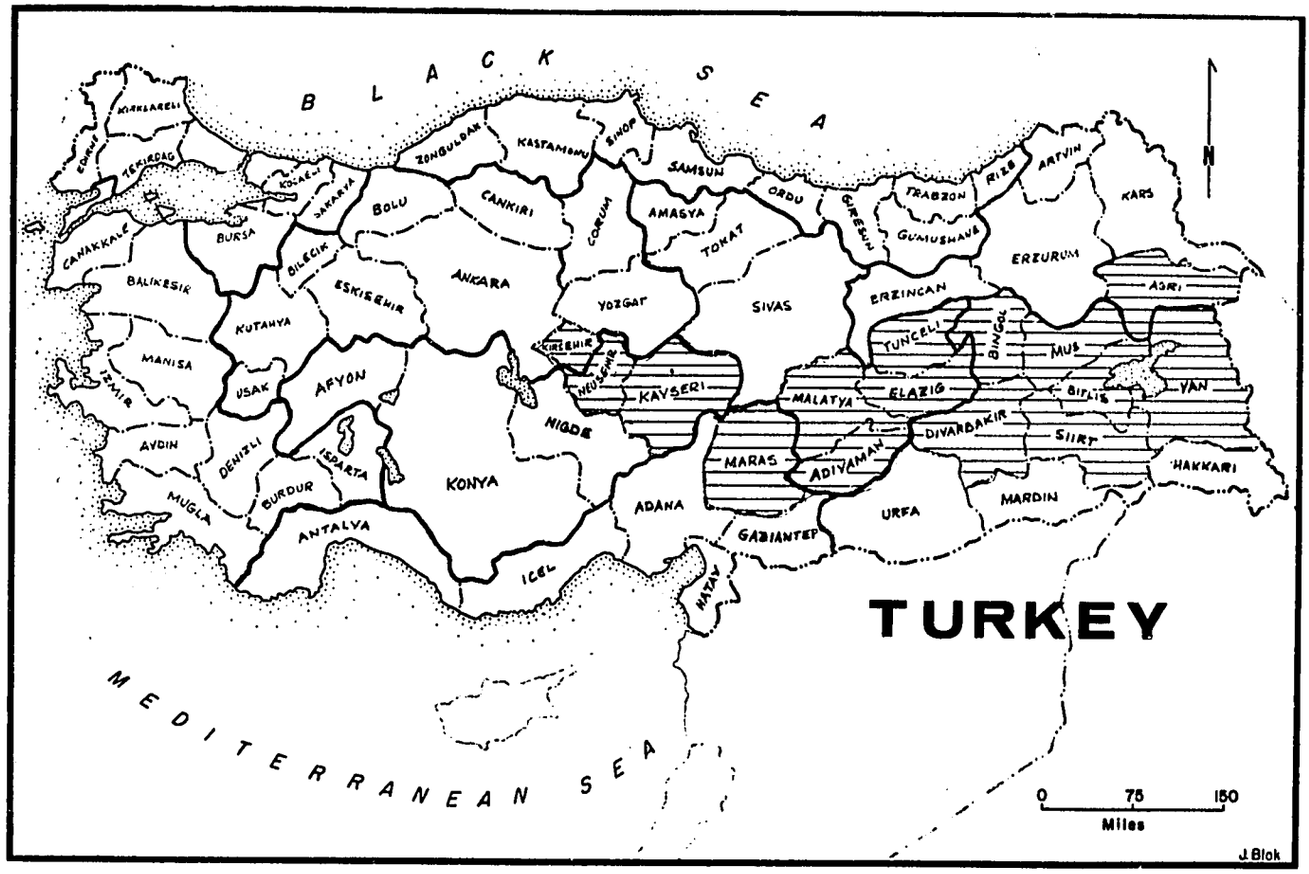
Section III. Describes equipment stipulation for import, equipment factories and plants.

The State Directorate of Agricultural Implements and Pesticides assumes the duty of testing and enforcing the pesticide regulation and specification. Pesticide quality, residue determinations, and toxicology studies are conducted by the same institute. The Directorate was set up in 1958 and presently employs six chemical engineers and 20 agronomists.

PESTICIDE REGISTRATION

Pesticide registration is somewhat different in

Map 9. Distribution of Dodder in Turkey.



Map 10. Distribution of wild licorice in Turkey.

Turkey than in the U.S. The process includes both chemical and biological registration.

Chemical registration: A pesticide and its specifications, along with physical and chemical properties, are submitted to the General Directorate of Plant Protection at Ankara. In the specification, toxicological data are also required. Pesticide samples are then sent to the Directorate of Agricultural Implements and Pesticides of the Ministry of Agriculture. The pesticide is tested for comparison to its specifications. Upon completion of the chemical registration, a committee makes decisions for biological tests.

Biological test: Samples of the pesticide are tested for biological activity at the regional weed research laboratory. Test results are supplied to the General Directorate of Plant Protection and to the chemical company. Biological tests are conducted either at the state farms or at the weed research laboratories. A final decision on registration of the pesticide is then made.

GOVERNMENT POLICY ON HERBICIDES

The Ministry of Agriculture encourages farmers to use herbicides for weed control. In general, the first year herbicides are given free to farmers. Spraying is performed through the services of the state - county agents. This is an initiation, demonstration and acquaintance program.

The second year, farmers pay half the price of the total herbicide cost. If they decide to use it in the coming years they have to pay the full cost of the herbicide.

Phenoxy type herbicides are mainly applied by aircraft. Turkey has one privately owned company and one state agency for aerial spraying work.

HERBICIDE INDUSTRY AND PESTICIDE USAGE IN TURKEY

Turkey used approximately 62 tons of pesticides in pest control in 1968. About 80 percent of the pesticides were used in Adana and Izmir provinces. Table 2 shows pesticide companies that are operating in Turkey until 1970 [4].

TABLE 2

MAJOR NATIVE AND FOREIGN PESTICIDE COMPANIES IN TURKEY

Turkish Representative or Turkish Manufacturing Company	*Foreign Company*	*Herbicide*
Hektas	*Chevron*	*Paraquat*
Hektas	*Diamond Alkali*	*Dacamine*
Hektas	*Hercules*	*Herban*
Hektas	*Geigy*	*Atrazine, Simazine*
Hektas	---	*2,4-D; 2,4,5-T*
	Shell	*Dalapon, Ethylene dibromide*
	Dupont	*Monuron, Linuron, Diuron, HyvarX*
	Bayer	*2,4-D, Amitrole*
Koruma	---	*2,4-D; 2,4,5-T*
Koruma	*Elanco*	*Treflan*
Koruma	*Velsicol*	*Dicamba*
Koruma	*Rohm & Haas*	*Nitrofen*
	Hoechst	*Diuron, monolinuron*
At-Arslan	*BASF*	*Pyramin*
Kimyagerler, Agro-Merck	---	*CIPC*

As shown in Table 3, total pesticide usage has tripled in the last decade. It is believed that total herbicide value will approximate the total pesticide value within the next decade.

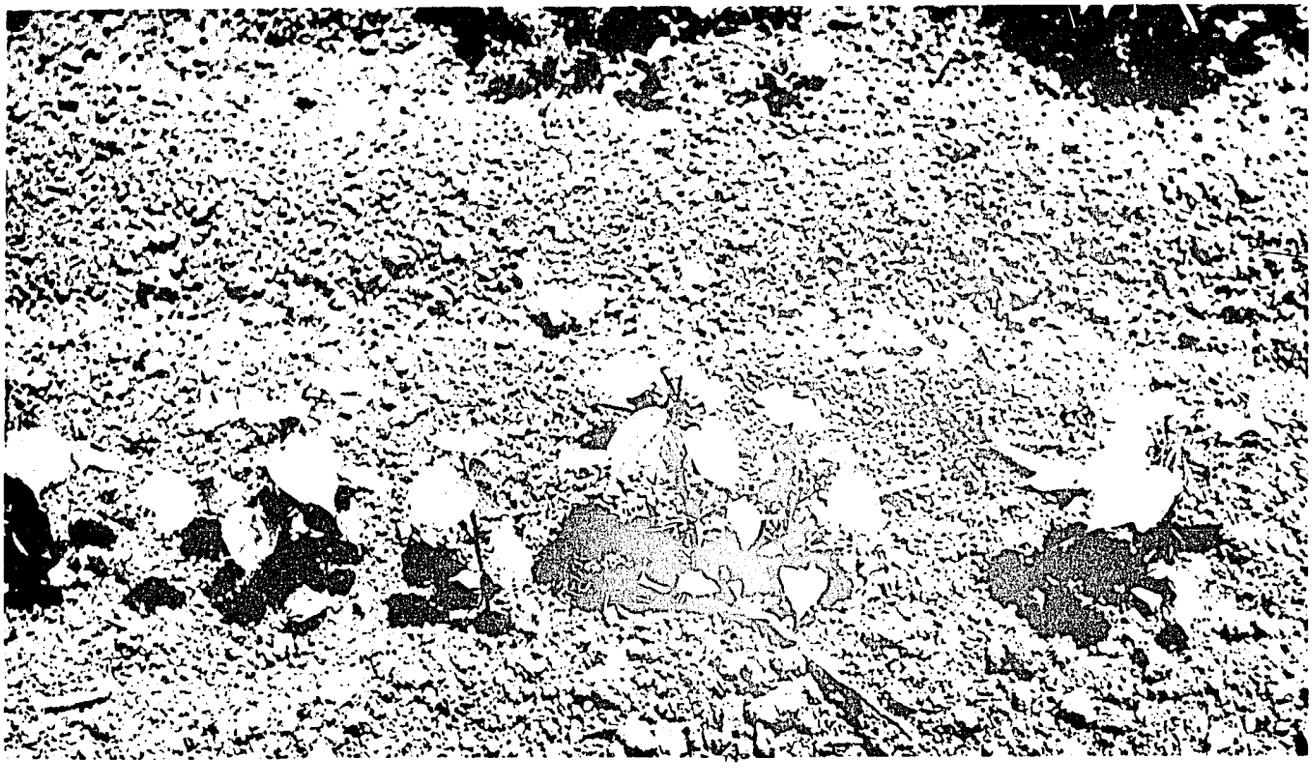
Use of pesticides requires the necessary spray equipment. At the present time there is one company in Ankara that is basically manufacturing conventional ground spray equipment.

Johnsongrass, field bindweed, mesquite, and purslane infestation in a cotton field in Adana Valley.

TABLE 3

TOTAL PESTICIDE USAGE IN TURKEY (metric tons)

Years	*Produced in Turkey*	*Imported*	*Total*
1959	*22.9*	*3.7*	*26.5*
1960	*21.1*	*2.3*	*23.4*
1961	*20.3*	*3.4*	*23.7*
1962	*31.3*	*7.1*	*38.4*
1963	*34.1*	*3.3*	*37.4*
1964	*33.4*	*2.7*	*35.6*
1965	*33.6*	*2.1*	*35.7*
1966	*36.1*	*2.0*	*38.1*
1967	*37.6*	*2.5*	*40.1*
1968	*51.3*	*11.0*	*62.3*



Cotton field treated with Treflan in Adana Province.

FUTURE OUTLOOK

Turkey needs a strong weed research organization plus extensive study and teaching on weeds. Turkey and the Middle East are expected to be a good market for pesticides in the future. The Oregon State University effort on weed control in Turkey will have a remarkable effect in building a better organization and increasing communication to help solve the weed problems of Turkey. It is hoped that the program will include a long-term interest.

APPENDIX

COMMON AND SCIENTIFIC NAMES OF THE MAJOR WEEDS OF TURKEY GROUPED BY FAMILIES

SCIENTIFIC NAME	COMMON NAME
GRAMINEAE	
Avena fatua L.	wild oats
Bromus tectorum L.	downybrome
Cynodon dactylon L.	bermudagrass
Echinochloa crusgalli L. Beauv.	barnyardgrass
Phragmites communis Trin.	common reed
Setaria verticillate L. Beauv.	bristly foxtail
CYPERACEAE	
Cyperus rotundus L.	purple nutsedge
Cyperus marianthus L.	mariant nutsedge
LILIACEAE	
Allium vineale L.	wild garlic
POLYGONACEAE	
Polygonum aviculara L.	prostrate knotweed
Polygonum convolvulus L.	wild buckwheat
Polygonum lapotifolium L.	red sorrel
Rumex acetocella L.	sheep sorrel
Rumex conglomeratus Murr.	cluster dock
CHENOPODIACEAE	
Chenopodium album L.	common lambsquarters
Chenopodium glaucum L.	oakleaf goosefoot
Salsola kali L.	Russian thistle
AMARANTHACEAE	
Amaranthus caudatus L.	
Amaranthus retroflexus L.	redroot pigweed
Amaranthus viridus L.	slender amaranth
PORTULACACEAE	
Portulaca cloracea L.	common purslane
CARYOPHYLLACEAE	
Agrostemma githago L.	corn cockle
Stellaria media Gyrill.	chickweed

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COMMON AND SCIENTIFIC NAMES OF THE MAJOR WEEDS OF TURKEY GROUPED BY FAMILIES

SCIENTIFIC NAME	COMMON NAME
RANUNCULACEAE	
Delphinium orientale Gay.	oriental larkspur
Ranunculus arvensis L.	corn buttercup
Ranunculus repens L.	creeping buttercup
PAPAVERACEAE	
Papaver hybridium L.	field poppy
Papaver rhoeas L.	corn poppy
CRUCIFERAE	
Boreava orientalis jaub. et spach.	yellow weed
Camelina sativa L. Cratz.	largeseed false flax
Capsella bursa-pastoris L. Medic.	shepherdspurse
Lepidium campestre L. R. Br.	field pepperweed
Lepidium draba L.	hoarycress
Lepidium latifolium L.	perennial pepperweed
Raphanus raphanistrum L.	wild radish
Sinapis arvensis L.	charlock
Thlaspi arvense L.	field pennycress
ROSACEAE	
Rosa spp.	
Rubus idaeus L.	red raspberry
LEGUMINOSAE	
Alhagi camelorum Fisch.	camelthorn
Astragalus collinus Boiss.	milkvetch
Astragalus voloratum L.	loco
Glycyrrhiza glabra L.	licorice
Prosopis stephaniana (willd.) spr.	mesquite
ZYGOPHILLACEAE	
Tribulus terrestris L.	puncturevine

APPENDIX

COMMON AND SCIENTIFIC NAMES OF THE MAJOR WEEDS OF TURKEY GROUPED BY FAMILIES

SCIENTIFIC NAME	COMMON NAME
EUPHORBIACEAE	
Euphorbia spp.	spurge spp.
MALVACEAE	
Malva rotundifolia L.	dwarf mallow
FRANKENIACEAE	
Hypericum crispum L.	
Hypericum perforatum L.	St. Johnswort
UMBELLIFERAE	
Conium maculatum L.	poison hemlock
Daucus carota L.	wild carrot
Turgenia latifolia Hoffm.	greatbur parsley
ERICACEAE	
Rhododendron pontium L.	pontic rhododendron
CONVOLVULACEAE	
Convolvulus arvensis L.	field bindweed
Convolvulus galaticus L. Rostor.	wild morningglory
Cuscuta arvensis Beyrich.	field dodder
Cuscuta epithymum L. Weihe.	clover dodder
Cuscuta europaea L.	great dodder
LABIATAE	
Lamium amplexicaule L.	henbit
Lamium purpureum L.	red deadnettle
Salvia spp.	sage spp.
SCROPHULARIACEAE	
Orobanche minor Sm.	clover broom
Orobanche ramosa L.	hemp broomrape
Veronica agrestris L.	field speedwell

APPENDIX

COMMON AND SCIENTIFIC NAMES OF THE MAJOR WEEDS OF TURKEY GROUPED BY FAMILIES

SCIENTIFIC NAME	COMMON NAME
PLANTAGINACEAE	
Plantago lanceolata L.	buckhorn plantain
Plantago major L.	broadleaf plantain
DIPSACACEAE	
Cephalaria syriaca L. Schrad.	Syrian scabious
COMPOSITAE	
Centaurea repens L.	Russian knapweed
Anthemis arvensis L.	mayweed
Anthemis tinctoria L.	yellow chamomile
Arthemisia absinthium L.	absinth wormwood
Centaurea depressa Bieb.	
Centaurea calcitrapa L.	purple starthistle
Centaurea cyanus L.	cornflower
Carduus pycnocephalus jacq.	Italian thistle
Centaurea solstitialis L.	yellow starthistle
Cirsium acarna L.	
Cirsium arvense L. scop.	Canada thistle
Cirsium eriophorum L. scop.	wool thistle
Cirsium lanceolatum L. Hill	spear thistle
Onophordon acanthium L.	Scotch thistle
Senecio vulgaris L.	common groundsel
Sonchus arvensis L.	perennial sowthistle
Sonchus asper L.	spiny sowthistle
Sonchus oleraceus L.	annual sowthistle
Taraxacum oficinale Weber	dandelion
Tragopogon pratensis L.	meadow salsify
Xanthium spinosum L.	spiny cocklebur

Researchers visit a cotton field treated with Treflan in southern Turkey. Left to right: Mr. Ramazan Turker of Adana; Dr. W. R. Furtick, Director, International Plant Protection Center, Oregon State University; Mr. Cedved Sevintun of General Directorate of Plant Protection; Dr. Naima Göksel (Kurhan), Ankara; Dr. Homer Hepworth, OSU team leader in Turkey; two local county agents; and Ercan Güneyli, research assistant.

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