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Summary

[illegible] pulse crop [illegible] were [illegible] diseases were [illegible] lentil, [illegible] [illegible] country are made.

INTRODUCTION

In cooperation with the U.S. Agency for International Development (USAID) [illegible] government, the U.S. Department of Agriculture has established the Regional Pulse Improvement Project with center in Tehran, Iran and New Delhi, India. [illegible] to improve the production and improve the quality of the pulse crops [illegible] these areas. Pulse production is important source of protein for the people of Asia where [illegible] population, [illegible] and dietary [illegible].

Iran, [illegible] 3[illegible],000 [illegible] of pulse crops [illegible] yield of 500-700 pounds [illegible]. The pulse crops [illegible] commonly cultivated are [illegible] (Vicia faba), broad bean (Vicia faba), [illegible] (Cicer arietinum), [illegible] (Vigna unguiculata), lentils (Lens culinaris), [illegible] (Phaseolus vulgaris), and, to a lesser extent, peas (Pisum sativum).

In land area, Iran is slightly larger than Alaska. [illegible] of the country is located on semi-arid plateau (3000-5000 feet) surrounded by mountain ranges in the north and south. Annual rainfall over most of the country, except in the Caspian Sea littoral, ranges between 5-15 inches and most of it falls between November and April. Around the Caspian Sea, it falls at all seasons of the year, with an annual precipitation of 25-50 inches (Table 1).

Iran is divided into seven provinces (ostans) and dependencies (farmandari) (Table 2). For convenience, the provinces and dependencies have been arranged numerically and alphabetically, respectively, on the map in Figure 1. An attempt has been made to indicate the distribution of each disease by provinces and districts.

The information presented in this report has been obtained from numerous surveys made during 1966 and 1967 in various pulse-growing centers of Iran. Diseased plant specimens were

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Table 1. Average monthly temperature (°C) and rainfall (mm) from sites located in provinces of Iran for 3-8 years ending 1963[a].

Month	Location within each Province[b]																					
	1 Karaj		2 Gorgan		3 Rasht		5 Rezaiyeh		7 Kermanshah		8 Dezful		9 Shiraz		10 Esfahan		11 Mashad		12 Kerman		13 Zahedan	
	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm	°C	mm
January	4	27	9	81	8	89	0	34	3	66	14	68	6	34	4	15	3	26	5	32	7	39
February	4	14	10	60	7	96	1	52	4	44	15	34	3	34	7	12	3	24	8	19	11	12
March	8	41	11	104	9	130	6	48	7	60	18	37	11	41	11	11	7	47	11	42	15	18
April	15	51	16	77	14	53	12	64	12	88	24	37	15	43	15	25	14	64	16	32	19	20
May	18	22	22	46	19	41	17	45	17	37	30	14	21	88	20	8	19	16	20	16	24	10
June	23	6	25	59	22	56	21	19	22	3	36	0	26	0	25	1	23	7	25	1	27	0
July	30	3	27	42	24	36	25	3	27	0	37	0	28	0	28	8	26	TR[c]	27	5	28	0
August	25	0	27	33	24	72	24	2	26	0	38	0	27	0	27	0	24	TR	25	0	26	0
September	22	0	25	36	21	185	20	3	21	0	35	0	24	0	23	0	20	1	22	5	22	0
October	14	17	19	87	17	222	18	15	16	15	28	7	18	0	15	1	13	2	16	1	18	0
November	8	32	13	87	12	174	7	37	8	48	20	60	11	44	9	7	7	13	9	11	11	11
December	4	20	10	60	8	131	2	21	4	53	14	61	7	56	4	10	3	17	5	18	8	17
										[414]				[390]								
Total		233		772		1285		343		415		318		310		96		217		182		127

[a]Information taken from a report prepared by C. B. Allen, USAID/Tehran (1965), of climatological data from 35 selected sites.
[b]Provinces are indicated by Arabic numerals. Please refer to Table 2 for identification of the Provinces. [c]Trace.

collected in the field and brought to Karaj Agricultural College (located near Tehran) where further studies were conducted in the laboratory and greenhouse on identification and pathogenicity of the microorganisms or viruses associated with the diseased plants.

DESCRIPTION OF DISEASES

BEAN -- Virus diseases: Bean common mosaic virus (BCMV), which is the most widespread and important disease of bean in Iran, is seed transmitted through more than 50% of the seed of many bean varieties tested in Iran. Yield reductions of up to 68% were observed in bean varieties infected with BCMV. The disease occurred in all but 1.5% of 1952 selections grown in our conservation trials at Karaj College. This virus was found wherever beans were grown.

A recently identified aphid-transmitted virus, variously known as broad-bean yellows, bean leaf roll, pea leaf roll, pea top yellows, or subterranean clover stunt virus (2, 6, 7) was observed in bean plantings in the provinces of Tehran and Fars. Infected plants are stunted with shortened internodes and there is pronounced rolling, thickening and crinkling of the leaves. Additional surveys, accompanied by field and greenhouse studies, will be required before we can assess the importance of this virus in bean production.

Bean yellow mosaic virus (BYMV), which is aphid-transmitted but not seed-borne in beans, is limited in distribution; it was observed only sporadically in the provinces of Tehran, Fars and Khuzestan.

Root rot diseases: Root rot occurs in all the bean-growing areas of the country, and in certain locations it has been a limiting factor in the production of this crop. The following fungi have been isolated from the roots of diseased plants, and the pathogenicity of these microorganisms is currently under investigation: Rhizoctonia solani Kuehn, Macrophomina phaseoli (Maubl.) Ashby, Phytium spp., Phytophthora sp. and Fusarium spp.

Foliar diseases: Angular leaf spot caused by Isariopsis griseola Sacc. (Phaeoisariopsis griseola (Sacc.) Ferr.) and rust caused by Uromyces phaseoli (Reben.) Wint. var. typica Arth. were seen occasionally in the provinces of Gilan and Mazandaran.

BROADBEAN -- Virus diseases: Bean yellow mosaic virus (BYMV), an

Table 2. The provinces and districts of Iran are arranged numerically and alphabetically, respectively, to correspond with the [illegible] of Iran (Fig. 1).

	Province (Ostan)	Capital City
1	Central Ostan	Tehran
2	Mazandaran	Sari
3	Gilan	Rasht
4	Eastern Azerbaijan	Tabriz
5	Western Azerbaijan	Rezaiyeh
6	Kurdistan	Sanandaj
7	Kermanshahan	Kermanshah
8	Khuzestan	Ahwaz
9	Fars	Shiraz
10	Esfahan	Esfahan
11	Khorasan	Mashad
12	Kerman	Kerman
13	Sistan and Baluchestan	Zahedan
14	Ports and Islands of the Persian Gulf and Sea of Oman	Bandar Abbas
	Districts (Farmandari)	
A	Simnan	Simnan
B	Hammadan	Hammadan
C	Lurestan	Khorramabad

FIGURE 1. Iran, with a land area of approximately 630,000 square miles, is divided into provinces (ostan) and districts (farmandari), which are listed numerically and alphabetically, respectively, in Table 2.

aphid-transmitted seedborne disease of broadbeans, is an important disease of this crop every year in Iran. No resistance to BYMV was found in any of the 85 broadbean lines grown in observation trials in Khuzestan. In 20 lines comprising over 19,000 plants, there was only 0.2% seed transmission of the virus. Three months later at maturity, however, BYMV had spread to over 85% of the plants. Broadbeans infected with BYMV have been found in the provinces of Tehran, Gilan, Mazandaran, Kermanshahan, Esfahan, Fars and the district of Luristan.

Pea leaf roll virus was observed in 72 of the 85 broadbean lines included in the Khuzestan trial. Infected plants are chlorotic, stunted and usually sterile. It is commonly found in association with BYMV and the virus infects peas and beans, and possibly other pulse crops, including cowpeas, mungbeans and chickpeas. Pea leaf roll virus is found in most areas where broadbeans are grown, and is an important disease of this crop in Khuzestan and Fars provinces.

Viruses of lesser importance and distribution are alfalfa mosaic (AMV) and cucumber mosaic (CMV) observed in the provinces of Tehran and Khuzestan, respectively.

Foliar diseases: In the humid areas of Iran (Gilan, Mazandaran and Khuzestan), foliar diseases incited by chocolate spot (Botrytis fabae Sardiña) and rust (Uromyces viciae-fabae (Pers.) Schroet.) have caused large crop losses when climatic conditions were ideal for disease development, such as occurred in Khuzestan in the spring of 1966, when diseases reduced broadbean yields by over 56% (4).

CHICKPEA -- Virus diseases: In Iran chickpeas are naturally infected by three viruses -- alfalfa mosaic (AMV), bean yellow mosaic (BYMV), and cucumber mosaic (CMV). These three chickpea viruses are transmitted mechanically and by aphids, but apparently are not seedborne. In field inoculation studies, yields were reduced 72-96% with AMV, 77-92% with BYMV, and 52% with CMV. Alfalfa, cucurbits and numerous leguminous weeds, particularly sweet clover (Melilotus spp.) act as a reservoir for AMV, CMV and BYMV, respectively, and several aphid vectors which transmit these viruses to chickpeas and other pulse crops. In a planting of six chickpea lines, 5-13% of the plants were naturally infected with BYMV. Yields from virus-infected plants were reduced an average of 98%.

Root rot diseases: Root rot is an important disease of chickpeas in most chickpea-growing areas of Iran. Root rot is caused by several soilborne fungi. The pathogenicity of Rhizoctonia solani, Macrophomina phaseoli, Pythium sp. and Fusarium spp. to roots of chickpeas has been proved in greenhouse inoculation studies.

Foliar diseases: Ascochyta blight caused by Ascochyta rabiei (Pass.) Labrousse was seen occasionally in the provinces of Tehran, Mazandaran, and West Azarbaijan. Rust (Uromyces sp.) was observed only once in Mazandaran province. Powdery mildew (Erysiphe sp.) occurs sporadically in the drier areas where chickpeas are grown.

COWPEA -- Virus diseases: A seedborne, aphid-transmitted virus, tentatively identified as cowpea aphidborne mosaic (CAMV), is the most important and widespread disease of cowpeas in Iran. It is found in the provinces of Tehran, Khorasan, Mazandaran, West Azarbaijan, East Azarbaijan, Gilan, Esfahan, and Fars. This virus appears to be similar to the one described by Lovisolo and Conti (5) infecting cowpeas in Italy. Greenhouse and field inoculations with CAMV reduced yields 44-80%. Seed transmission in 26 lines ranged from 0-30+ %, and seed yields from infected plants were reduced 13-83%. From field observations and greenhouse inoculation studies with 54 cowpea lines, 6 were found to be highly resistant to CAMV.

Cowpeas infected with alfalfa mosaic virus (AMV) were observed in the provinces of Tehran and Shiraz. This virus is a potential threat to cowpeas growing near virus-infected alfalfa. In greenhouse and field inoculation tests yields from virus-infected plants were decreased 17 to 76%. The virus does not appear to be seedborne in cowpeas. In greenhouse tests no resistance to AMV was found in 54 cowpea lines.

Root rot diseases: Several potentially pathogenic soilborne fungi have been isolated from necrotic roots of cowpeas grown in the provinces of Tehran and Khuzestan. These include Rhizoctonia solani, Macrophomina phaseoli, Pythium spp. and Fusarium spp.

Foliar diseases: Cercospora leaf spot (possibly C. cruenta Sacc.) and rust (Uromyces phaseoli var. vignae (Barcl.) Arth.) occur occasionally on cowpeas during the wet season in the provinces of Gilan and Mazandaran. In the drier areas powdery mildew (Erysiphe polygoni DC. ex Mérat) occurs, but is seldom serious.

LENTIL -- Virus diseases: Bean yellow mosaic virus and AMV were recovered from stunted plants with deformed and mottled foliage. Virus-infected lentils were found only in Tehran province and the disease was of no consequence.

Root rot diseases: A serious root rot disease infected over 1200 lines of lentils in our field plots in Tehran province. Varying degrees of resistance to root rot were observed in the lentil strains included in this trial. Lentil root rot was also prevalent, but less damaging, in

the provinces of Fars, West Azarbaijan, and in the district of Hamadan. The fungi isolated from necrotic and rotted roots in the Khuzestan [illegible], P. [illegible] and Trich., Macrophomina phaseoli, and Fusarium spp.

MUNG BEAN -- Virus diseases: One of the most economically important and widespread diseases of mungbean in Iran is an aphid-transmitted, [illegible] virus, tentatively called mungbean mosaic virus (MMV). This virus, which is [illegible] 750 nm in length, appears to be a strain of bean common mosaic virus based on host reactions, host range, physical properties, serology and electron microscopy. In field tests with 17 mungbean lines, seed transmission ranged from 0 to 25%. Yields from virus-infected plants were reduced 2.8 to 5.6 times. Mungbeans infected with MMV were found in the provinces of Tehran, Khuzestan, Gilan, West Azerbaijan, Esfahan, and Fars.

Root rot diseases: A serious root disease of mungbean in Gilan, Rhizoctonia solani causes 4 to 57% mortality in young plantings in Tehran province. Several other root rot fungi have been isolated: Macrophomina phaseoli, [illegible], Pythium sp., and Fusarium spp.

PEA -- Virus diseases: Pea leaf roll virus and BYMV are prevalent in pea plantings located in Tehran and Khuzestan provinces. Pea leaf roll virus is a potential threat to the pea crop in Khuzestan where in a large planting over 60% of the plants were infected with this virus.

DISCUSSION

Pulse crops are cultivated widely in most countries of Southwest Asia, including the Middle East, and often provide a major source of protein in the diets of the people for economic or religious reasons. Yields of pulse crops in these countries are generally low (1). Disease is one of the factors that contribute to poor yields. In the past 2 years diseases have been a major contributing factor to reduced yields of several pulse crops grown in different parts of Iran (3, 4).

Weather conditions greatly influence the types of legume diseases which occur in Iran. Root rot and virus diseases have been most prevalent in the drier areas of the country. In the wetter and more humid locations, however, particularly in the south in Khuzestan and in the north around the Caspian Sea, foliar diseases have been very important and destructive (3, 4).

Many of the diseases listed in this paper, especially those caused by viruses and foliar fungi, are thought to be previously unreported in Iran, and most probably elsewhere in the pulse-growing areas of the Middle East.

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