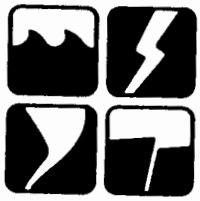
Natural Hazard Research

DROUGHT COMPENSATION PAYMENTS IN ISRAEL

by

Dan Yarden

1973



Working Paper #24

PREFACE

This paper is one in a series on research in progress in the field of human adjustments to natural hazards. It is intended that these papers will be used as working documents by the group of scholars directly involved in hazard research as well as inform a larger circle of interested persons. The series is now being supported from funds granted by the U.S. National Science Foundation to the University of Colorado and Clark University. Authorship of papers is not necessarily confined to those working at these institutions.

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INTRODUCTION

Dan Yarden was an employee of the Israeli Property Tax and Compensation Fund when Amiram Gonen of the Hebrew University brought us together in the summer of 1971. This paper had been prepared two years earlier as a seminar paper in the school of economics at the Hebrew University. Translation and intercontinental communication slowed the production process, but given the uniqueness of the Israeli experience and the intimate knowledge of the author, distribution to the wider audience of Working Paper readership seems justified even at this late date. The essential facts have not been changed over the four ensuing years.

Thanks then to Dan Yarden for sharing his experience, apologies to him for our failings in translation, and thanks as well to Saul Cohen, Diana Conyers and Amiram Gonen for their editorial help.

Bob Kates
Clark University
1973

A Survey of Field Crop[1] Production in Israel

Irrigation is seldom used for field crop production in Israel and so production is almost entirely dependent on rainfall. Virtually all the dry land suitable for cultivation is now in use and, because of the droughts which have occurred in recent years in the Negev and other parts of the country, there is now a tendency to reduce the land under cultivation.

The total area sown with field crops in 1959 amounted to about two million dunams[2]: of these 1.5 million dunams were in Jewish possession and 0.5 million dunams belonged to minority groups. The major part of this area, about 90% (1.8 dunams), was sown with winter crops, and only 10% was occupied by summer crops. The success of summer crops depends only indirectly on precipitation, since they are sown at the end of the rainy season. The amount of precipitation determines, therefore, the size of the area to be sown with summer crops but not the yields, which can be predicted. Winter crops, on the other hand, are directly dependent on rainfall and, since less than 10% receive supplementary irrigation, the majority are left to the mercy of heaven. The amount of precipitation thus actually determines the size of the yields, which range from 400 kg in a good year to nil in a year of drought. Moreover, the risk is increased by the fact that, of the total area of 1.8 million dunams under winter crops, over 1.25 million dunams are in the Negev, Lachish, South[3] and Beth Dhean areas, which are prone to droughts.

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[1] The term field crop (falhah) refers to grain and fodder crops.

[2] One dunam = one-quarter of an acre = $\frac{1}{10}$ hectare.

[3] The area between Kefar Menahem in the South and Gedera in the North.

The most important winter crop is wheat, which occupies more than one million dunams, that is about 60% of the total area under winter crops. The second crop is barley, occupying about 350,000 dunams, mainly in lands belonging to minority groups. 320,000 dunams are sown with hay, in the Jewish sector only, and another 40,000 dunams or so, with other winter crops of minor importance.

The distribution of winter crops has undergone in recent years changes which are, at least in part, a direct result of the Ministry of Agriculture's policy. The main change has been to expand the area allotted to wheat, while the barley area has been reduced (Table 1). This change was induced by several factors:

a. wheat's profitability (its price being one-third higher than that of barley);

b. wheat's higher yield per unit of land;

c. barley's greater vulnerability to diseases, and the failure to verify the assumption that barley succeeds better in arid conditions.

During the first part of the 1950's the usual yields per dunam of both wheat and barley ranged between 100 and 150 kg in good years, whereas today they average around 250-300 kg of wheat and 200 kg of barley.

Table 1

Wheat and Barley Cultivation in the Jewish Sector
in the Years 1950-1969

	Wheat		Barley		
Year	Area in dunams	Yield kg/d	Area in dunams	Yield kg/d	Comments
1950	188,000	105	260,000	110	
1	231,000	45	418,000	60	Drought, increased sowing in the Negev
2	170,000	130	665,000	130	
3	169,000	110	667,000	85	Partial drought
4	173,000	140	611,000	125	
5	320,000	90	452,000	80	Drought (1)
6	411,000	150	397,000	175	
7	383,000	170	315,000	170	
8	421,000	135	379,000	125	Partial drought
9	444,000	150	344,000	165	
1960	440,000	80	328,000	65	Drought
1	466,000	125	306,000	140	Partial drought
2	316,000	150	309,000	135	Partial drought
3	363,000	130	327,000	85	Drought (2)
4	421,000	275	358,000	230	
5	547,000	245	187,000	215	
6	586,000	155	136,000	90	Drought
7	716,000	275	105,000	238	
1968	875,000	188	80,000	175	Partial drought
1969	820,000	200	74,000	180	Partial drought (3)

(1) Until 1955 priority given to barley
(2) 1955-1963 wheat sown areas equal barley sown areas; 1964 priority to wheat
(3) Estimate

Source:

"Data on chief field crops" - the Ministry of Agriculture, Field Crop Department, June 1969.

The following is a comparison between the yields of wheat kg/d in several countries, in 1968:

Italy - 209 kg/d; Greece - 149 kg/d; Australia - 135 kg/d; U.S.A. - 189 kg/d; Denmark - 485 kg/d; Netherlands - 478 kg/d; Israel - 188 kg/d.

The increase in wheat production is illustrated in the following table:

Table 2

Domestic Production and Consumption of Wheat in Israel*

	1950 tons	1960 tons	1967 tons	1968 tons
Total Consumption	187,000	330,000	340,000	388,000
Total Production	19,700	35,000	210,000	165,000
Domestic Production as % of total consumption	11%	11%	62%	46%

The government's policy is to encourage the expansion of domestic wheat production with the aim of achieving self-sufficiency. There is a two-phase plan which is designed to increase annual production to 322,000 tons (75-80% of consumption) by 1975 (Table 3).

According to this plan, 80% of the production will be from dry farming, with 70% of the area concentrated in the Negev, Lachish, South and Beth Shean areas, which are stricken by drought every few years. Years of severe drought may thus obstruct these plans to the extent of reducing production by one-third to one-half of the forecast.

Field crop production, like other forms of agriculture, has in recent years, undergone considerable improvement, in terms of the

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*"Data on chief field crops" - the Ministry of Agriculture, Field Crop Department, June 1969.

Table 3

Plans for Increasing Wheat Production[1]

	Area (dunams)	Yield/kg/d	Production (tons)
Phase A - 1971 -- Ultimate aim 280,000 tons pa = 70% of consumption			
Irrigated lands under intensive cultivation	15,000	570	8,500
Supplementary irrigation - Negev, Lachish, South and Beth Shean	100,000	480	48,000
Dry farming in a good year	700,000	275	192,000
Minorities in the North, Center and Northern Negev	200,000	160	32,000
Phase B - 1975 -- Ultimate aim 322,000 tons pa = 75-80% of consumption			
Irrigated lands	45,000	620	28,000
Supplementary irrigation	100,000	500	50,000
Dry farming	700,000	300	210,000
Minorities	200,000	170	34,000

[1] "Data on chief field crops" - the Ministry of Agriculture, Field Crop Department, June 1969.

efficiency of cultivation methods, selection of suitable species, use of fertilizers and warfare against weeds, and this has also affected yields.

Table 1 thus shows the effects of, on the one hand, improvements in production and, on the other hand, years of drought, on the yields of field crops during the last 20 years. The increase in average yields in the course of that period can be traced. While in 1950 an average of 100 kg/dunam wheat was considered a good yield, in 1959 a reasonable yield was 150 kg/d; in 1964 it was 350 kg/d; and today a good yield is 300-350 kg/d. This increase is a result of constant improvement in cultivation methods and of an intensification of production. However, although there has been an increase in average yields, there have been major fluctuations from year to year as a result of variations in the amount and distribution of precipitation and it is this factor which ultimately has the greatest influence on yields in a particular year.

The Definition of Drought and the Conditions Necessary for Field Crop Cultivation

Israel's location between Egypt, where rain is scarce, and Lebanon with its abundance of precipitation, makes it a transitional area, in which rainfall increases rapidly from the south, which is a subtropical desert, to the north, which has a subtropical humid climate. The great differences in the amount of rainfall within our region are unmatched by those in other countries of a similar size. Within the boundaries of Israel there is a true desert where

less than 30 mm rain are received per year -- the Arava; a semi-desert with 50-75 mm to 150-200 mm rain per year -- the Negev and the Dead Sea Valley; agricultural areas which receive 300-600 mm; and mountain areas with up to 1,000 mm. The area occupied by the agricultural population receives rain amounts exceeding 250 mm; winter crops need a minimum of 250 mm to yield a minimum crop of 100-150 kg/d, unless there is sufficient moisture accumulated in the soil from the previous year.

It would be pointed out that, contrary to current notions, the amounts of rain falling over the cultivated parts of Israel are not smaller than those received in agricultural countries of the temperate zone. The difference between Israel and such countries is not in total annual rainfall but in the number of rainy days, and in the rain's intensity per day and per hour. In Israel the entire amount of rainfalls in a six month's season, in 40-60 days of rain, whereas in the temperate zone it is distributed over twelve months in 180 days of rain and snow. In dry years in Israel, the number of rainy days, as well as the total amount of rain, decreases; while in extremely humid years the amount of rain and the number of rainy days may be double that of a normal year.

The country may be divided in terms of its climatic suitability for field crops into three regions:

a. Desert and arid areas where there is no year with a sufficient amount of rain for field crops in dry farming, and where the amount of rain never exceeds 250 mm per year.

b. Regions where there is every year a sufficient amount of rain to maintain field crops by dry farming, and the precipitation always surpasses 300 mm.

c. An intermediate region, where there is a great variability in rainfall. The long-term average figure is about 300-350 mm, but it may decrease to 100 mm in arid years and increase to 450-500 mm in good years.

Most of the lands with potential for winter crop growing are concentrated in the region defined here as region "c." Since the region lacks water sources other than natural precipitation, and since additional water brought from the north will, in the near future, supply only a very small portion of the region, the choice seems to be between growing field crops on dry land and abandoning the region for agricultural purposes. The size of the region is about 500,000-600,000 dunams (Figure 1).

On the one hand this region may yield, in a rainy year, an average of 250 kg grains, permitting a production of more than 100,000 tons of wheat and constituting about one-half of the potential national consumption (Table 1). On the other hand, in a dry year, the cessation of rain may render the region's yields extremely poor, down to less than one-quarter of the amounts mentioned above.

Our definition of a year of drought will pertain to a year when the scarcity, or distribution, of rain damages the dry farming crops. It should be emphasized here, that drought damages can be inflicted in years of more than 300-350 mm rain. The distribution of precipitation over the season has a decisive significance with regard to crops

success. We know of years of drought, in the past, when the total amount of precipitation surpassed the long-term average for the season; still, a continuous cessation of rain over one month to two months damaged the plants, thus reducing yields to at least half of the expectations. The last year of drought, 1959, may serve as an example. The first rains came on time, in October, and until February the amount of rain received surpassed the season's long-term average. Then, from the middle of February to the beginning of April there were no rains at all, and most of the fields were gravely affected. Then, a large amount of rain, unusual for April, improved somewhat the situation, yet, it could not undo the great damage caused by the cessation of rain in March. Thus, although the annual amount of precipitation exceeded the long-term average, severe drought damages were inflicted.

Two categories of drought -- "severe" and "partial" -- are distinguished for purposes of the damage inflicted and the compensation paid. A "severe" drought is when income does not cover production costs and the damaged area covers more than one-half million dunams.

A Survey of Drought Damage Compensation Payments and the Law Regulating These Payments

When the first eleven settlements were established in the Negev, in 1946, field crops production was also established in the region, since soil was the main resource that the national institutions were able to offer to the settlers. Still, the

actual development of the settlements began only after the War of Independence. The government encouraged the Negev settlements, at that time, by subsidy grants; in order to increase the production of grains for fodder for livestock, and also so that there would not be large areas left uncultivated.

Field crops was the main branch of agriculture in the Negev settlements, and their income constituted about 50% of the total income. When the "Yarkon-Negev Project" was completed, millions of cubic meters of water were available to provide supplementary irrigation, in order to increase the yields and counteract the damages of droughts that occurred in the region. Equipment for supplementary irrigation of 60,000 dunams was purchased with the assistance of the Ministry of Agriculture. The results of supplementary irrigation were encouraging, and the damage caused in years of drought was greatly reduced. However, with the development of permanent irrigation land in the region, the amounts of water allotted for supplementary irrigation were reduced from one year to the next, until in 1962, field crops were not allotted any water. In the years 1967-1968 attention was once again turned to the supplementary irrigation field crops with the assistance of governmental loans for laying irrigation pipes in new areas, in order to increase grain production and prevent drought damages. In 1969 80,000 dunams of wheat were provided supplementary irrigation in areas liable to drought.

Until 1961 compensation payments for drought damages were taken from the ordinary budget on the recommendation of the Ministry of Agriculture. In thirteen agricultural years, from the establishment of the State to 1962, there were three years of severe drought and four years of partial drought. During that period about IL 45 million were paid in compensation (in current prices).

Since 1962 compensation has been paid according to the regulations of "Property Tax and Compensation Fund (compensation payment) (drought damages) 1964." From 1962 to 1969 there were two years of severe drought and three years of partial drought. During that period about IL 36 million were paid (in current prices).

Table 4

Payment of Compensation for Drought Damages in 1962-1969

Year	Dunams for which compensation was paid	IL sum paid	Average compensation per dunam IL
1962	435,000	7,237,000	16.70
1963	553,000	10,405,000	18.80
1966	562,000	12,834,000	22.70
1968	120,000	1,916,000	15.90
1969	225,000	4,000,000	17.70

In order to understand the procedure by which drought compensation is paid today, it is necessary to examine the basic principles of the compensation regulations.

According to the regulations, "drought damages" occur when a "vulnerable plant" fails to sprout, or sprouts with no resulting yield or a poor yield, or when there is other loss of yield of the vulnerable plant in the "stricken area," as a result of insufficient amount of precipitation, or untimely precipitation. "The worth of drought damages" (that is, the compensation paid), for any kind of "vulnerable plant," equals the cultivation costs minus the return received or expected in the "stricken area." In the case of a severe drought, the compensation usually amounts to 80-90% of the production costs.

"Stricken areas" and "vulnerable plants" are defined by the Minister of Finance following consultation with the Minister of Agriculture.

In November 1961 Moshe Dayan, then Minister of Agriculture, nominated a committee whose task was to recommend to him areas in the Negev where years of drought are very frequent and sowing field crops is not advisable. The committee was also to make alternative suggestions for the utilization of this area.

Relying on that committee's recommendations a "drought line" was drawn along latitude 80° (Israel grid), south of which drought damages are not compensated, and the risks of sowing in this area are the farmer's alone. (As mentioned before, unirrigated field crops are grown in these areas, too, today.) According to regulations

no compensation is paid below the "drought line," and it has been declared "a restricted area" (Figure 1).

Another region, designated as "the Negev region" (80°-110° Israel grid), has been allotted compensation at the rate of 100% of the damage. Other areas which are declared stricken areas (110°-130° Israel grid) receive lower rates of compensation, ranging from 70% to 90%, according to the extent of the damage. The higher the damage, the higher the rate of compensation.

The basis of the regulations is thus that compensation should cover production costs. In cases where there is no income, the full sum of costs is to be paid out of the fund. If there is some income, the payment equals the difference which is needed to cover the production costs. The law does not extend compensation on unrealized profits. The following example illustrates this point:

The production costs for a dunam of wheat are	IL 37.
The expected yield in a normal year is	250 kg/d
The price of one ton of wheat is	IL 310.
The expected income is 77.	IL 77.5

If there is no income at all, the compensation paid in the Negev area will amount to IL 31., equalling production costs minus saved costs (harvest costs). A yield of 100 kg/d gives an income of IL 31. The compensation in such a case will be IL 6/d. No compensation is paid when the yield is 120 kg/d. The regulations, then, do not grant compensation in cases where the agriculturist has received only one-half of the reasonably expected yield.

Production Costs Over Time in Different Regions

In order to simplify this analysis, we will discuss wheat growing as representative of all dry land field crops. We are justified in choosing wheat as a representative crop, since it is today the chief winter crop and since the area under wheat is constantly expending at the expense of other crops.

An examination of production costs for one dunam of wheat in the last twenty years shows that they are steadily increasing (Table 5).

Table 5

Average Production Costs for One Dunam of Wheat
1951-1969 IL (current prices)

Before the enactment of the "Property Tax" law concerning compensation for drought damages.		After the enactment of the law concerning payment of compensation for drought damages.	
1951	6	1962	24
1952	8	1963	28
1953	11	1964	30
1954	14	1965	31
1955	18	1966	33
1956	19	1967	33
1957	19	1968	37
1958	19	1969	37
1959	19		
1960	19		
1961	20		

Source: Income Tax calculations of cultivation costs for one dunam of field crops and calculations of drought committees.

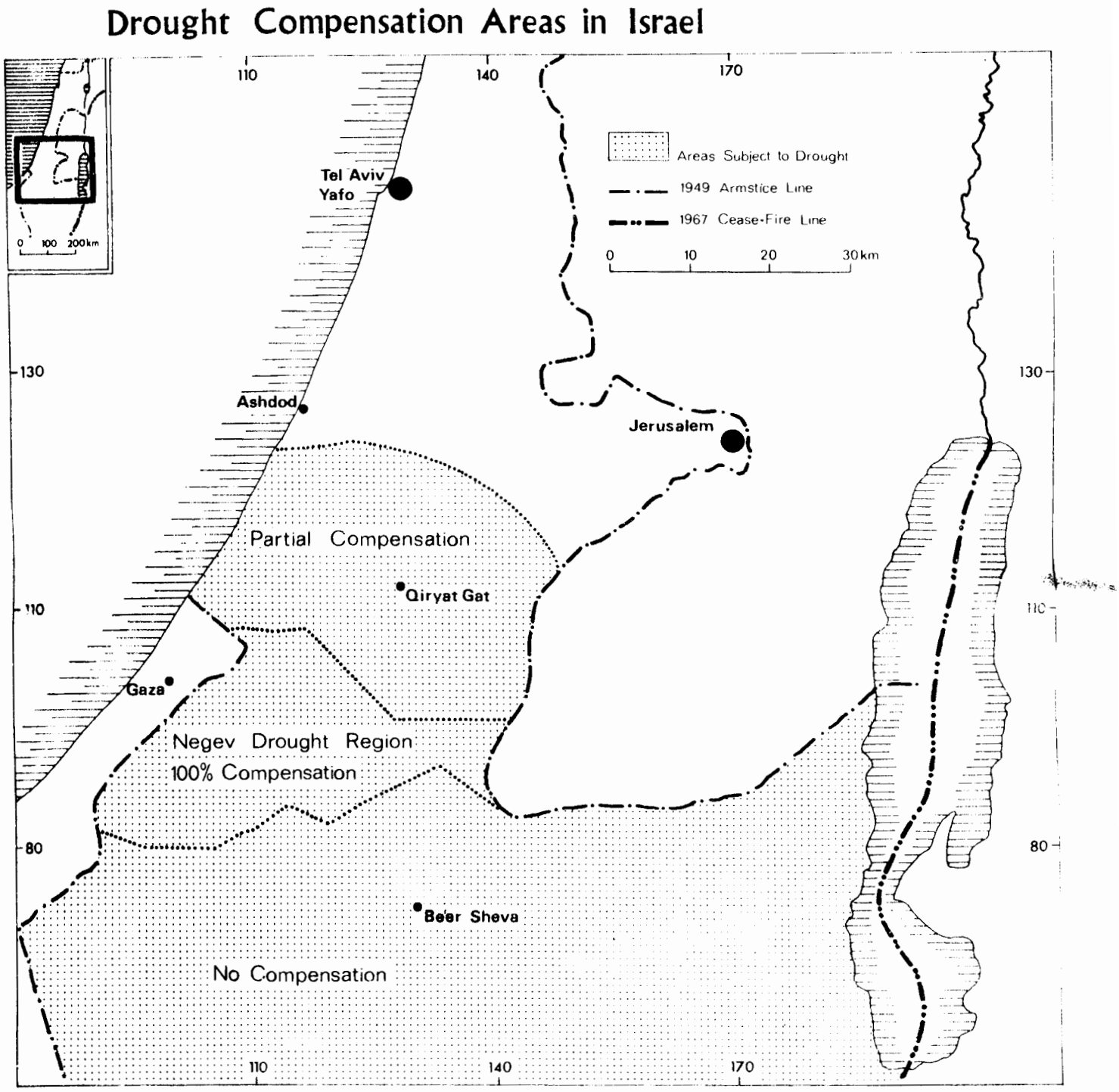

Drought Compensation Areas in Israel
110
140
170
130
110
80
0 100 200km
Areas Subject to Drought
1949 Armstice Line
1967 Cease-Fire Line
0 10 20 30km
Tel Aviv
Yafo
Ashdod
Jerusalem
Partial Compensation
Qiryat Gat
Gaza
Negev Drought Region
100% Compensation
Beer Sheva
No Compensation

Figure 1

It is interesting to examine the effect that the Property Tax law, concerning compensation for drought damages, has had on the inputs of wheat growing. From 1961 to 1966 the index of input prices in agriculture rose from 115 points to 152 points (1960 = 100) that is, a rise of 32%. The production costs in current IL rose during the same period from IL 20/d to IL 33/d, a rise of about 65%. If we deduct the rise in input prices, we find that the actual rise in wheat growing inputs in those five years was about a third. This was a result of considerable addition of fertilizers and weed killers and the use of improved species.

Since we have no data on past conditions, the comparison of production costs between regions will be based on present conditions. When we examine the level of production costs for wheat growing in an area which is not prone to droughts and so does not need compensation (above latitude 130°, Israel grid), we find that it is IL 37/d. A similar examination in a "restricted area" (an area below the drought line, where, as mentioned before, no compensation is paid for drought damages) shows that the level of production costs averages IL 15-20/d -- that is, 50% less than that in an area which is not liable to droughts.

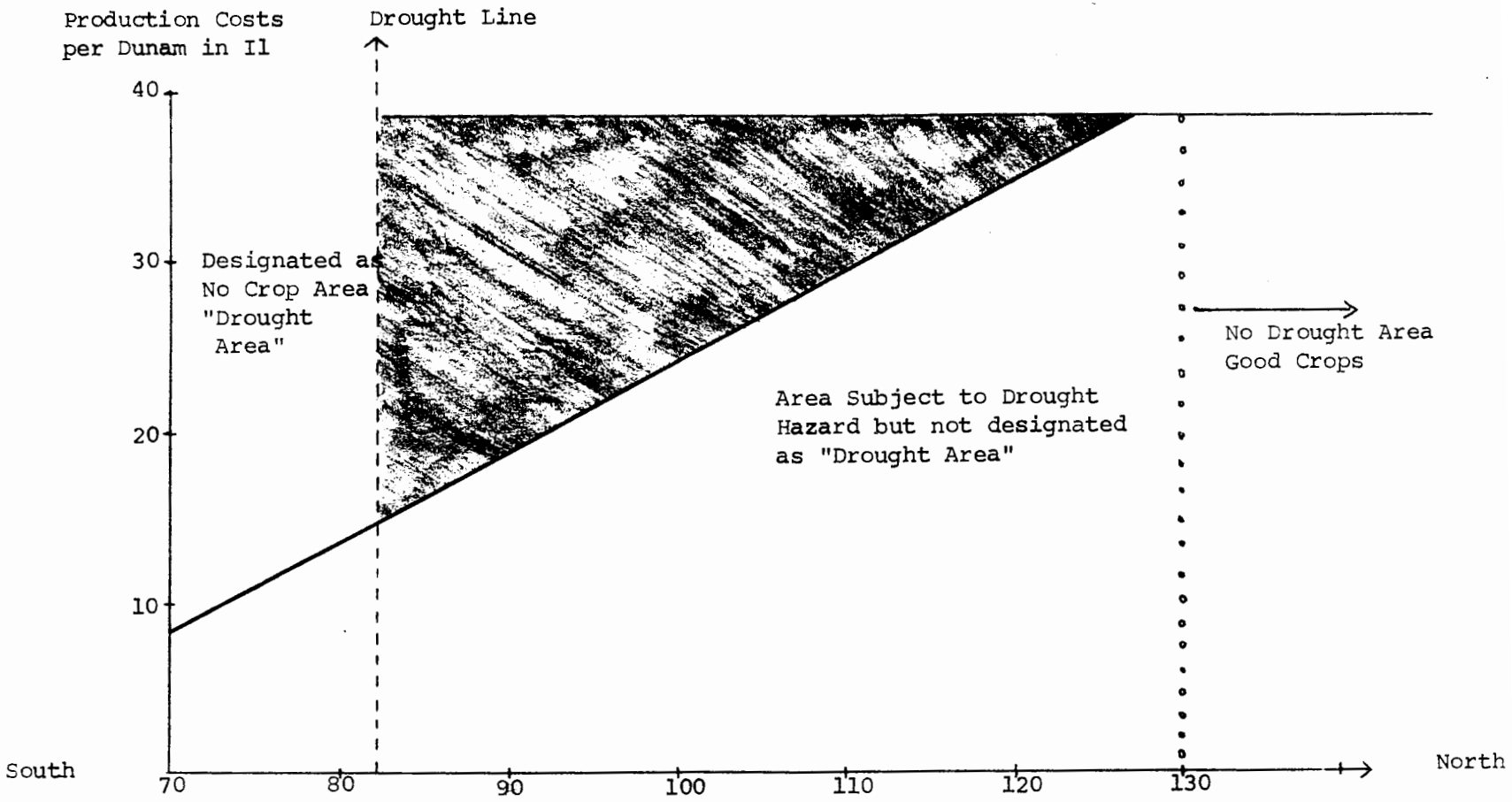
This suggests that as drought liability increases (that is, as one moves southward) the level of production costs will diminish in direct proportion. However, this is not the case. Above the drought line there is a leap in production costs from the low level of IL 15-20/d to IL 36/d, which is as high as that found in the rainy

areas which do not suffer from droughts (Figure 2). In this region, which lies between latitudes 80° and 130°, Israel grid, one-half million dunams of winter field crops are grown on dry land. This is an area which is stricken by droughts every few years and which receives most of the compensation payments for drought damages. As a result there are only two levels of production costs in operation: a high level in regions which are not affected by drought and in those where compensation is paid and a low level in the region below the drought line where no compensation is paid.

It is thus apparent that the compensation regulations have the effect of increasing production costs in areas which are subject to drought but are guaranteed compensation. The additional annual production costs (indicated by the shaded area on the graph) amount to IL 4.6 million, which, in turn, results in additional compensation payments of about IL 3.5 million in a year of drought, since compensation is paid on the basis of production costs.

Income from Field Crop Production

In this section we shall calculate the income obtained from field crop production and compare the profits made with and without compensation payments. The relevant data (based on current yields, wheat prices and production costs) are given in Table 6.



Estimated level of Production Costs if No drought compensation were paid.

Actual Level of Production Costs.

Figure 2

a. 1954 -- production costs per dunam -- IL 14; a good yield -- 120 kg/d; price per ton -- IL 227; income per dunam -- IL 25; expected profit in a good year about 75%.

b. 1958 -- production costs per dunam -- IL 19; a good yield -- 150 kg/d; price per ton -- IL 230; income per dunam -- IL 34; expected profit in a good year about 75%.

c. 1961 -- production costs per dunam -- IL 24; a good yield -- 233 kg/d; price per ton -- IL 255; income per dunam -- IL 45; expected profit in a good year about 85%.

d. 1965 -- production costs per dunam -- IL 31; a good yield -- 233 kg; price per ton -- IL 277; income per dunam -- IL 64; expected profit in a good year about 100%.

e. 1969 -- production costs per dunam -- IL 37; a good yield -- 275 kg; price per ton -- IL 310; income per dunam -- IL 85; expected profit in a good year about 130%.

It is, then, obvious that in the last fifteen years field crop production has developed to the extent that profits in good years have increased from 75% in 1954 to 130% in 1969. Since we have concluded that the profit, based on the present day technology and the expected income level, without drought compensation, is

about 30%, we may conclude that prior to 1969 production was unprofitable without drought compensation. This can be demonstrated by repeating the above analysis, using yield, price and cost data for 1958, as shown in Table 7. This indicates that in 1958 without drought compensation production would barely have broken even so, at that time, the subsidy was justifiable.

Table 7

Income from Field Crop Production 1950-1969, Based on 1958 Data

	Type of year			
	Good	Partial drought	Severe drought	Average 1950-1969
Number Years 1950-1969	9	6	5	0
Yield kg/d	150	50	0	-
Income IL/d	34	12	0	-
Total income 1950-1969 IL/d	306	72	0	19
Total costs 1950-1969 IL/d	-	-	-	19

The Effect of Drought Compensation on the Field Crops Sector

In this section dealing with production costs we showed the extent to which production costs have increased as a result of drought compensation. We will, now, attempt to answer some questions arising from that analysis:

a. How much more grain is produced as a result of the increase in production costs, as described above?

b. How much does it cost to produce the additional amount of grain?

c. How is the financing of this production shared between the farmer and the government?

In order to answer these questions we will examine a representative dunam over twenty years, assuming two different levels of production costs, first IL 28/d and then IL 37/d. The first level represents the costs that would have been found in the area under discussion, had drought compensation not been paid, while the second, represents the actual situation. The examination will be based on present day technology, yields and wheat prices.

With production costs at the level of IL 37.7 the average yield in a good year is 275 kg/d, and with production costs at IL 20/d, it is 200 kg/d, which is the average yield received below the drought line, where less intensive methods of production are used.

With production costs at IL 20, the production of one ton of wheat costs IL 100, whereas production costs of IL 37 means a cost of IL 135 per ton; hence, the marginal returns to increased investment are negative.

On this basis, it will be correct to assume an average yield of 240 kg/d in a good year with production costs at the level of IL 28/d, which means that production costs per ton of wheat are IL 115.

With regard to a year of severe drought, the answers are simple since at both levels of production costs the yield is nil.

In a year of partial drought the yield received when production costs are IL 37 averages 80 kg/d. It may be assumed that with production costs at IL 28/d, the yield will not rate much lower, since the limiting factor (water) determines in such a case the yield's level, while other factors have only a minor influence. For purposes of analysis we will assume a yield of 70 kg/d.

We may now use these estimates to calculate the returns for the twenty year period from 1950-1969 for each level of production costs.

a. Production costs -- IL 37/d

9 good years	x 275 kg/d	= 2475 kg x IL 310/ton	= IL 765
6 years of partial drought	x 70 kg/d	= 420 kg x IL 310/ton	= IL 150
5 years of severe drought	x 0	=	0

Return for grains produced IL 915

Total grain production per dunam in the course of those twenty years, 2.95 tons.

The agriculturist received for that yield IL 915 for the grains plus IL 247 drought compensation, totalling IL 1,162.

Production costs per dunam in twenty years -- IL 710. (See previous section).

b. Production costs -- IL 28/d

9 good years	x 200 kg/d	= 1800 kg x	IL 310/ton	= IL 558
6 years of partial drought	x 70 kg/d	= 420 kg x	IL 310/ton	= IL 130
5 years of severe drought	x 0	=		0
			Return for grains produced	IL 688

Total grain production per dunam in the course of those twenty years, 2.22 tons.

Drought compensation for production costs of IL 28/d will be:

5 years of severe drought based on IL 20 (no harvest)	IL 100
6 years of partial drought based on IL 6[1] (harvest)	IL 36
Total drought compensation	IL 136

For a yield of 2.22 tons the farmer received IL 688 plus drought compensation IL 136, totalling IL 824.

During that period production costs per dunam were:

15 years (harvest) based on IL 28	=	IL 420
5 years of drought (no harvest) based on IL 22	=	IL 110
Total		IL 530

The estimated difference in grains between the two levels of production costs is 2.95 minus 2.22 tons = 730 kg grains.

Difference of estimated production costs:	IL 180 = 710-530
Difference of estimated drought compensation:	IL 111 = 247-136
Total	IL 291

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[1] Production costs -- IL 28, minus income -- 70 kg x IL 310 = IL 21. Since the rate of compensation is less than 100%, the difference is only IL 6 for compensation.

From this analysis we may draw the following conclusions:

1. The average additional production per dunam over the twenty year period was 730 kg.
2. The production of those 730 kg cost IL 291, that is, there were production costs of IL 400/ton.
3. The government paid IL 225 for those 730 kg (IL 310/ton) plus IL 111 drought compensation, totalling IL 337, which is equivalent to IL 462/ton.
4. The government pays $75/ton for imported wheat which means that the cost of a saved dollar is IL 6, compared to the exchange rate of IL 4.2/dollar.
5. The addition in grain production for twenty years was 730 kg; hence, in one year (long-term average) we received an addition of 35 kg/d as a result of the change from the low production costs, which would have been expected had drought compensation not existed, to the actual high production costs.
6. Since the above analysis refers to about one-half million dunams, the change in production costs will add every year an average of about 17.5 thousand tons, constituting about 5% of domestic consumption, and about 10% of domestic production.

Conclusions

We have shown that, at the present time, field crop production yields a reasonable long-run average rate of return when compared with other types of agriculture, without the payment of drought compensation. The present compensation payments, which formerly were needed to enable the farmer to break even, now increase the average rate of return from 30% to 60%.

The payment of drought compensation has two main objects: (a) to reduce the risk to the farmer from natural hazards, such as drought, and to guarantee him a reasonable profit; (b) to reduce the inequalities between farmers in different parts of the country by compensating those who live in areas like the Negev which are likely to suffer from droughts.

If the payment of compensation were terminated, the areas which are subject to drought would not be abandoned; farmers would continue to cultivate them and, by using a different technology and thus having lower production costs, they would still secure a reasonable profit. Moreover, the total cost to the government would be reduced.

However, there would be two problems. Firstly, the production of domestic grain would be reduced, thus necessitating the use of foreign exchange to import grain; and, secondly, the income gap between farmers in the north and the south would remain.

We therefore suggest an alternative system of compensation which would eliminate the inequalities between the two groups of farmers without causing the abnormal distortion in production costs which exists at present. The new system would involve paying compensation on the basis of the amount of damage suffered in a particular area, not the production costs of the individual farmer. Affected areas would be classified according to the degree of damage and all farmers within the area would receive the same rate of compensation per dunam of land cultivated. The risk would then be with the farmer, who would have to calculate the optimum long-run level of production costs, taking into account the expected occurrence of drought.

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