Crop Selection in High-Risk Agriculture

By C. V. Moore and J. H. Snyder

Farmers the world over have long recognized and adjusted to problems of risk and uncertainty in crop production. Agricultural economists have also recognized the problem but have been somewhat frustrated in their attempts to find satisfactory solutions and techniques of analysis. Heady (4, ch. 17)[1] developed a logical framework for combining variances and for diversification of crop enterprises. Others (2) have made empirical estimates of price, yield, and income variability of crops and cropping systems for wide geographic areas based on this framework. Stovall (7) proposed use of quadratic programming to develop a rational expected income-variance surface from which farm managers can choose cropping plans depending on their propensity or aversion to risk. Alternative formulations of the problems have been within the framework of the theory of games (3). This paper suggests an additional formulation in which the objective is maximization of long-term expected gains. The results may conflict with many of the past formulations and suggested solutions which have emphasized short-term gains.

The Problem Setting

The Salinas Valley of California is an important contributor to the national market for summer head lettuce and other high-risk fresh vegetables (6). The local vegetable industry is highly vertically integrated, with only two marketing cooperative associations and several large packer-shippers contracting with a large number of small growers. A variety of open price contracts or "deals" link the packer-shippers and the growers. Depending on the contractual agreement made, a grower can transfer all or part of the risk of income variability to a packer-shipper. The contract can also be a source of operating capital to the grower through advances from the packer as well as assuring the grower a guaranteed market outlet for his produce. The marketing cooperatives provide their members only with an assured market outlet--they do not provide operating capital or accept any of the income risk due to price or yield variability. They also require that the member have sufficient financial backing to survive 3 poor crop years in succession.

The Problem and an Analogy

The problem is to select cropping programs for high-risk crops that maximize long-term expected gain, taking into account the operators' capital position and the variability of income from alternative crops.

A close analogy can be drawn between selection of cropping plans and investment portfolio analysis. Each crop enterprise is analogous to a marketable security--a stock share, a bond, or a savings certificate. The proportion of a particular crop enterprise to total crop acres is equivalent to the proportionate value of any one security to total investment portfolio value. Investors in securities (farmers) desire a portfolio (crop program) with the highest expected return. However, this is usually not the portfolio (crop plan) with the lowest income variance. Likewise, the portfolio (crop plan) with a low variance may have an unacceptably low expected return.

Any crop plan A, with the same expected income as crop plan B but a smaller variance than B, is superior if the objective of the investor is to achieve the highest expected immediate gains. If A had the same variance as B but a higher expected return, A would also be considered

[1] Underscored numbers in parentheses indicate items in the References, p. 97.

superior. Stovall terms superior crop plans as "efficient" on the basis of expected immediate returns (7). Thus, if the only criterion for selection of portfolios was maximizing immediate returns, all inefficient crop plans could be eliminated from consideration. But under a criterion of maximizing long-term gains, this may not always be the case.

Most studies of portfolio or cropping program selection under uncertainty implicitly assume that the investor or manager is constrained only by propensity or aversion to risk. We argue that this is in fact not the case, but that the investor's capital limitations impose real restrictions on his admissible alternatives. For example, unless purchase of fractional shares is allowed, a small individual investor with limited capital could not purchase expensive portfolios. A diversified portfolio with 10 different securities, each valued at $500, could not be purchased by an investor with only $3,000 to invest. Similarly, a farmer may also be limited in the choice of alternative efficient cropping plans. First, on technical considerations alone, the proportion of a single crop in the efficient cropping plan may be too small to make it economically feasible to grow. Second, a grower with limited capital may be excluded from certain cropping plans or even contractual agreements to grow certain crops. For example, the membership requirement in the marketing cooperative of sufficient financial resources to withstand 3 poor years excludes any grower without access to large amounts of liquid assets.

Five marketing arrangements for head lettuce, two for carrots, and one each for dry beans and sugarbeets were analyzed. Dry beans and sugarbeets were included to represent the low-income, low-variability field crop alternatives. Marketing arrangements for head lettuce and carrots are as follows:

LETTUCE

1. Marketing through a cooperative. All operating capital is furnished by the grower, who bears all of the risk and receives all proceeds from the crop.

2. A joint venture with a packer-shipper, the packer advancing one-half of the cultural costs to purchase a 50 percent share in the crop. Returns are split equally from the first carton harvested, and the balance of the operating capital is furnished by the grower.

3. A contract with a packer who advances $135 per acre in addition to furnishing one-half of the cost of pesticides and fertilizer. Proceeds from the crop are shared equally after deducting the cost of the packer's share of pesticides and fertilizer.

4. A minimum income guarantee contract with the packer advancing $135 per acre plus all hoeing and thinning costs. Proceeds are shared equally after the $135 advance has been repaid to the packer.

5. A flat fee of $300 per acre, paid to the grower to produce an acre of lettuce. There is no sharing of profits or losses by the grower.

CARROTS

1. A minimum guarantee of $135 per acre advanced by the packer plus one-half of the pesticides and fertilizer. Proceeds are shared from the first crate.

2. A payment of $275 per acre by the packer to grow a crop to maturity. Profits or losses are not shared.

Dynamic Programming

Dynamic programming, a mathematical extension of Markov process, has been developed by Belman (1), Howard (5), and others. The salient characteristics of Markov process are the state of the system and the transition from one state to another. A system occupies a state when it is completely described by the variables which define the state. A system makes a transition from one state to another usually over time, either discrete or continuous.

A simple example might make this approach more clear. Suppose a flower breeder has developed a variety which, in a given year, found a great demand in the market. Let a successful flower variety be defined as state 1. The flower breeder's competitor markets an improved variety the following year and sales of our breeder's variety fall off drastically. Let us define state 2 as an unsuccessful variety. If successful and unsuccessful varieties are the only possible states for the flower breeder, then superior. Stovall terms superior crop plans as "efficient" on the basis of expected immediate returns (7). Thus, if the only criterion for selection of portfolios was maximizing immediate returns, all inefficient crop plans could be eliminated from consideration. But under a criterion of maximizing long-term gains, this may not always be the case.

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A simple example might make this approach more clear. Suppose a flower breeder has developed a variety which, in a given year, found a great demand in the market. Let a successful flower variety be defined as state 1. The flower breeder's competitor markets an improved variety the following year and sales of our breeder's variety fall off drastically. Let us define state 2 as an unsuccessful variety. If successful and unsuccessful varieties are the only possible states for the flower breeder, then these two states completely describe the system. Suppose further that when the flower breeder is in state 1, his variety has a 50 percent change of finding favor with his customers in the following year (state 1). By the same token, it has a 50 percent chance of being out of favor with his customers, thus moving him to state 2. When the breeder is in state 2, assume that he has a two-thirds chance of having an unsuccessful variety in the following year (remaining in state 2) and a one-third probability of coming up with a successful variety and making the transition back to state 1. Schematically, these transitions can be shown as in figure 1.

In matrix form this can be stated as a transition matrix

$$P = \left[P_{ij} \right] = \begin{bmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{bmatrix}$$

A state probability can be defined as $\pi_i(n)$, which is the probability that the plant breeder will occupy the ith state after n transitions if the state at N = 0 is known. Since

(1) $$\sum_{i=1}^{n} \pi_i(n) = 1 \text{ and}$$

(2) $$\pi_j(N+1) = \sum_{i=1}^{N} \pi_i(n) P_{ij} \quad n = 0, 1, 2,$$

then,

(3) $$\pi(n) = \pi(0)\, P^n$$

Using this relation, it is possible to find the probability that the plant breeder occupies each state in the system after n transitions by post-multiplying the initial state probability by the nth power of the transition matrix.

Rewards for each transition may be included by defining a value $V_i(n)$ as the expected total earnings in the next n transitions if the system is now in state i and defining r_{ij} as the amount the system will earn if it makes the transition from state i to state j. The total expected earnings can be expressed as:

(4) $$V_i(n) = \sum_{j=1}^{N} p_{ij}\, r_{ij} + \sum_{j=1}^{N} p_{ij}\, V_j(n-1)$$

$$i = 1, 2, \ldots, N$$
$$n = 1, 2, 3, \ldots$$

In words, total expected returns equal the probability starting in state i of making a transition to state j times the reward earned for making the transition plus the expected reward from starting in state j with one fewer time period remaining.

In our example of the flower breeder, rewards or net returns for each possible transition can be assumed such that if he makes a transition from state 1 to state 1 the flower breeder earns 10 units of reward. If he remains unsuccessful for two periods in succession (transition from state 2 to state 2), his loss would be -6. If he changes from successful to unsuccessful or vice versa, he earns 4 units. Thus the reward matrix is:

$$R = \left[r_{ij} \right] = \begin{bmatrix} 10 & 4 \\ 4 & -6 \end{bmatrix}$$

and since $P = \begin{bmatrix} 1/2 & 1/2 \\ 1/3 & 2/3 \end{bmatrix}$

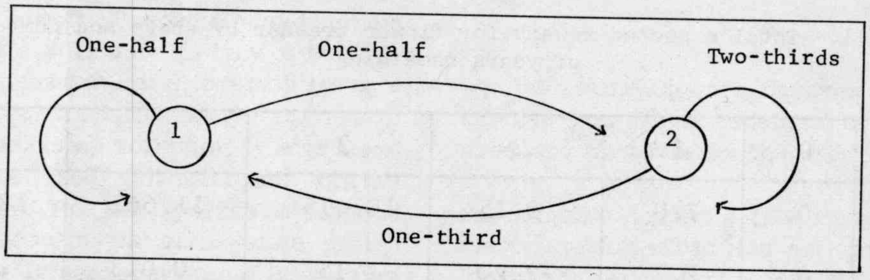


Figure 1.--Schematic diagram of transition probabilities.

immediate expected returns,

$$q_i = p_{ij}\, r_{ij} = \begin{bmatrix} 7.0 \\ -2.7 \end{bmatrix}$$

where

$$(5) \qquad q_i = \sum_{j=1}^{N} p_{ij}\, r_{ij} \qquad i = 1, 2, \ldots, N$$

then equation 4 reduces to

$$(6) \quad V_i(n) = q_i + \sum_{j=1}^{N} p_{ij}\, V_j(n-1) \qquad \begin{matrix} i = 1, 2, \ldots, N \\ n = 1, 2, \ldots \end{matrix}$$

(5, p. 18).

Suppose the flower breeder knows his greenhouses will be taken over by a subdivision at the end of 5 years and he wishes to know the amount of money he will make in that time depending on whether or not he now has a successful variety. Assuming that the business will have a zero salvage value at the time of urbanization, $V_i(0)$ can be set equal to zero.

Equation 4 can be used to calculate $V_i(n)$ for each state, for several values of n (see table 1). From table 1, if the flower breeder is 5 years from going out of business, he can expect to make 12.825 units in the time remaining if he now has a successful variety and only 1.14 units if he now has an unsuccessful variety for his customers.

Suppose the flower breeder is not restricted to chance alone as to whether or not he has a successful variety this year. In years of an unsuccessful variety, he has the alternative of investing additional funds and effort in research to find a more acceptable variety. During the year, when he has a successful variety, he can expend additional funds on advertising in order to keep the variety from losing acceptance. Therefore, in each state, the flower grower would have two alternatives. Associated with these additional alternatives would be a new set of transition probabilities and rewards.

A sequential decision problem involving one or more alternatives can be solved with a slight modification of equation 6 from Howard (5). Defining q_i^k as the expected reward from a single transition from state i following alternative k, then

$$(7) \qquad q_i^k = \sum_{j=1}^{N} p_{ij}^k\, r_{ij}^k$$

Howard (5, p. 28), redefines $V_k(n)$ as "the total expected return in n stages starting from i if an optimal policy is followed." Thus, equation 6 can be rewritten as

$$(8) \qquad V_i(n+1) = \max_k \left[q_i^k + \sum_{j=1}^{N} p_{ij}^k\, V_j(n) \right]$$

The problem becomes one of making the optimum decision in each time period in order to maximize long-term expected income. If each combination of decisions over the n time periods is defined as a policy, then the optimal policy would be one that maximizes total expected returns over the planning period. Howard (5) has developed an efficient algorithm which can be used to determine the optimum decisions in each stage, assuming that an optimum policy had been followed up to that stage. This algorithm can be used for any number of states, alternatives, and time periods up to the storage capacity of the computer.

Table 1.--Total expected reward for flower breeder by state and number of years remaining

n =	0	1	2	3	4	5
$V_1(n)$	0	7.0	9.15	10.475	11.662	12.825
$V_2(n)$	0	-2.7	-2.20	-1.15	-0.013	1.14

The lettuce growers' sequential decision problem was defined for a single farm size, 240 acres of irrigated land with a typical line of machinery and an assumed equity of 55 percent in machinery and equipment. For this single-size of farm, 10 states were defined representing 10 different gross operating capital levels or supplies. Within each state different cropping plans were defined as alternatives that could be selected by the grower. Lower numbered states contained alternatives (crop plans) with a high proportion of low-risk field crops and low-risk contractual arrangements for growing vegetables. In the higher numbered states, high-risk crop plans were specified requiring larger amounts of operating capital to be furnished by the grower. One state (state 1) was defined as a proxy for bankruptcy. For each alternative in each state there is an associated farm income. From this income must come funds to pay family living expenses, machinery loan payment, and personal income tax. The residual is a net addition to the operating capital supply.

Transition probabilities were determined by asking the question for each alternative, how many standard deviations of income (converted to areas under the normal curve) would be required from this crop plan to cover expenses and provide sufficient operating capital to move the system to the next state (operating capital supply)? Standard deviations were based on the total variance of net income for each crop plan.

Net income variability was estimated from a statistical time series of gross income less a series of cost data deflated by an index of prices paid for inputs in the vegetable industry. Tintner's variate difference method (8) was applied to this series to determine variances and correlation coefficients. Total variance of crop plans was determined using the well-known procedures for combining variances outlined by Heady (4).

A total of 10 states were defined, each with a set of alternative crop plans. Each time the grower makes a transition, either to another state or to the same state, he earns a reward. If the transition is to a lower numbered state, the reward is negative, reflecting a loss in operating capital. The reward for making a transition from one state to another was defined as the difference in operating capital used in defining the two states. For example, the reward for moving from state 5 to state 6 was $7,500. To move from state 5 to state 4 was -$5,000. Data used to calculate the transition probabilities are shown in table 2 and the estimated transition probabilities are shown in table 3.

Results

In contrast to the usual solution of farm management problems which attempts to maximize immediate expected income, dynamic programming not only takes into account immediate expected income for any starting state but also the income received if subsequent transitions cause a grower to land in a different state from whence he started. That is, the program calculates the rewards from starting state 3 plus the rewards the grower would receive by following an optimal policy if he lands in state 4, times the probability of making the transition to state 4.

Although the expected immediate income from a given alternative (crop plan) within a state may be lower than another alternative, the probability of making a transition to a higher state may be greater because of a higher variance of net income. Therefore, the policy which maximizes expected immediate gains may not maximize the long-term expected gains if we consider a large number of time periods.

Figure 1 shows expected incomes from each alternative plotted against its standard deviation. The solid lines indicate the restrictions imposed by the supply of operating capital used in defining the state. Since some alternatives were repeated in more than one state, these lines show the lowest state in which an alternative first appeared. The dashed curve represents the efficiency frontier. The policy iteration method defines an optimal policy as that set of alternatives (decisions) which maximizes the present value of income in all states. That is, the solutions indicate, for each gross operating capital level (state), the crop plan and contractual arrangement a grower should follow if his objective is to maximize long-term income. The optimal alternative in each state is indicated by the circled dots in figure 2.

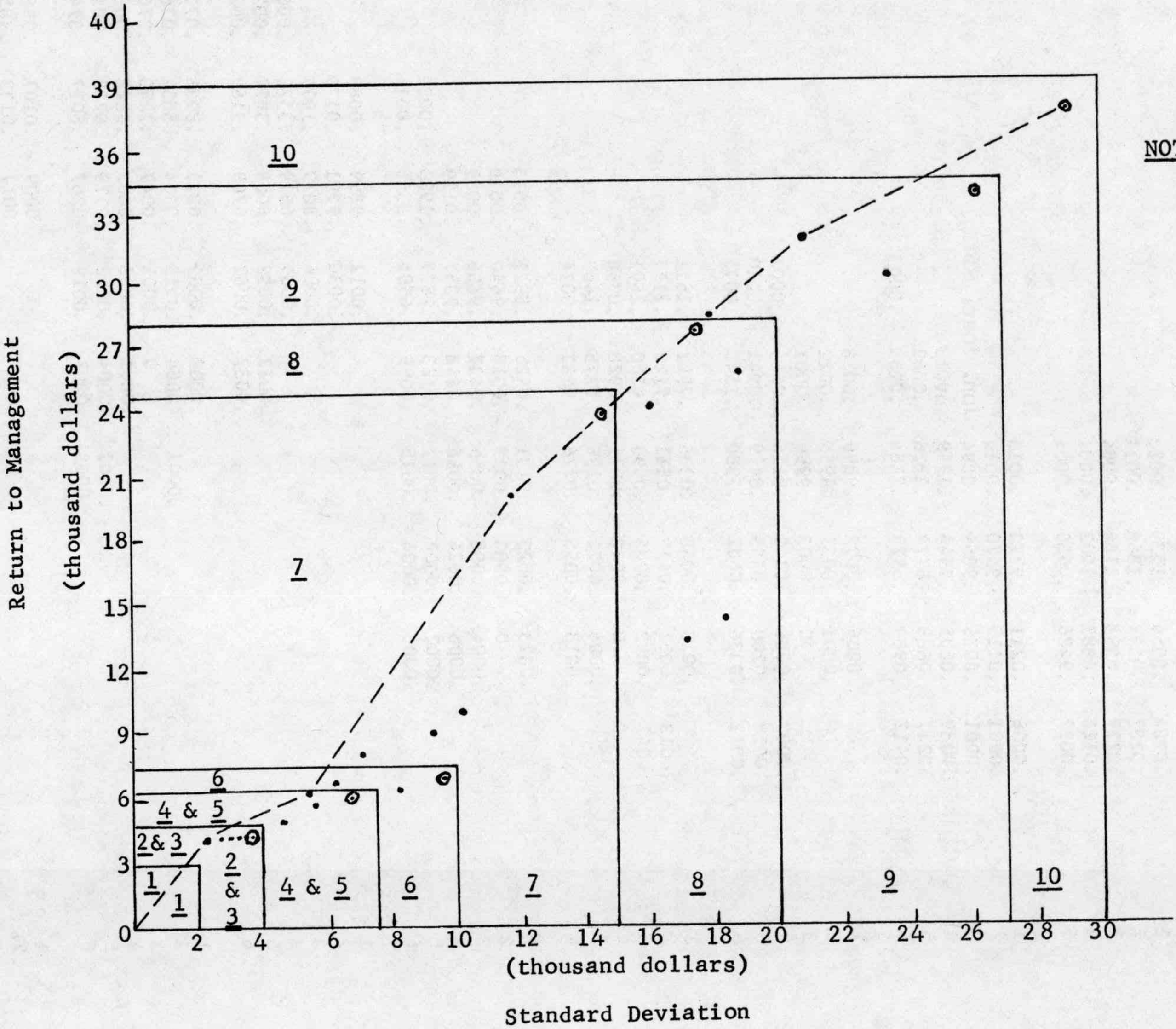
The optimal strategy for growers with very low operating capital supplies is not to follow

Table 2.--Income, family withdrawals, loan payments, marginal tax rates, and standard deviation about net income by state and alternative, Salinas Valley, Calif.

State	Operating capital	Alternative	Return to labor and management	Taxable income	Family withdrawal	Loan payment	Marginal tax rate	Standard deviation
	dollars		dollars				percent	dollars
1	0	1	0	0	0	0	0	0
2	7,500	1	9,556	8,556	5,200	1,845	22	3,497
		2	9,561	8,561	5,200	1,845	22	3,227
		3	9,566	8,566	5,200	1,845	22	2,974
		4	9,572	8,572	5,200	1,845	22	2,740
		5	9,582	8,582	5,200	1,845	22	2,168
3	11,250	1	9,556	8,556	5,200	1,845	22	3,497
		2	9,561	9,561	5,200	1,845	22	3,227
		3	9,566	8,566	5,200	1,845	22	2,974
		4	9,572	8,572	5,200	1,845	22	2,740
		5	9,582	8,582	5,200	1,845	22	2,168
4	15,000	1	9,566	8,566	5,200	1,845	22	2,974
		2	9,572	8,572	5,200	1,845	22	2,740
		3	9,582	8,582	5,200	1,845	22	2,168
		4	10,417	9,417	5,200	1,845	22	4,589
		5	10,852	9,852	5,200	1,845	25	5,587
		6	11,288	10,288	5,200	1,845	25	6,830
5	20,000	1	9,566	8,566	5,200	1,845	22	2,974
		2	9,572	8,572	5,200	1,845	22	2,740
		3	9,582	8,582	5,200	1,845	22	2,168
		4	10,417	9,417	5,200	1,845	22	4,589
		5	10,852	9,852	5,200	1,845	25	5,587
		6	11,288	10,288	5,200	1,845	25	6,830
6	27,500	1	11,288	10,288	5,200	1,845	25	6,830
		2	11,723	10,723	5,200	1,845	25	8,210
		3	12,164	11,164	5,200	1,845	25	9,675
		4	11,438	10,438	5,200	1,845	25	5,153
		5	11,840	10,840	5,200	1,845	25	6,276
		6	13,330	12,330	5,200	1,845	28	7,581
7	35,000	1	12,164	11,164	5,200	1,845	28	9,675
		2	13,330	12,330	5,200	1,845	28	7,130
		3	14,276	13,276	5,200	1,845	28	8,988
		4	15,228	14,228	5,200	1,845	32	10,228
		5	25,127	24,127	5,200	1,845	36	11,705
		6	29,008	28,008	5,200	1,845	39	14,586
8	55,000	1	14,276	13,276	5,200	1,845	28	8,988
		2	15,288	14,288	5,200	1,845	28	10,228
		3	25,127	24,127	5,200	1,845	36	11,705
		4	29,008	28,008	5,200	1,845	39	14,586
		5	32,923	31,923	5,200	1,845	42	17,542
		6	30,642	29,642	5,200	1,845	42	18,717
9	75,000	1	18,478	17,478	5,200	1,845	32	17,056
		2	19,296	18,296	5,200	1,845	36	18,216
		3	33,194	32,194	5,200	1,845	45	17,826
		4	36,962	35,962	5,200	1,845	48	20,714
		5	35,354	34,354	5,200	1,845	48	23,457
		6	39,122	38,122	5,200	1,845	50	26,283
10	100,000	1	35,354	34,354	5,200	1,845	48	23,457
		2	39,122	38,122	5,200	1,845	50	26,283
		3	42,889	41,889	5,200	1,845	53	29,167

Table 3.--Transition probabilities by state

State	Alter-native	1	2	3	4	5	6	7	8	9	10
1	1	.9999	.0001								
2	1	.0020	.8666	.1237	.0077						
	2	.0010	.8611	.1330	.0049						
	3	.0006	.8804	.1164	.0026						
	4	.0001	.8998	.0989	.0012						
	5	.0001	.9462	.0536	.0001						
3	1		.0384	.8054	.1539	.0023					
	2		.0287	.8334	.1368	.0011					
	3		.0217	.8593	.1186	.0004					
	4		.0116	.8881	.1002	.0001					
	5		.0037	.9426	.0536	.0001					
4	1		.0006	.0211	.9773	.0010					
	2		.0001	.0115	.9570	.0314					
	3		.0001	.0036	.9869	.0094					
	4		.0089	.0605	.7544	.1749	.0013				
	5		.0217	.0668	.6727	.2326	.0062				
	6	.0024	.0412	.0989	.5525	.2884	.0163	.0003			
5	1			.0006	.0072	.9896	.0026				
	2			.0001	.0031	.9956	.0012				
	3			0	.0003	.9996	.0001				
	4		.0003	.0086	.0240	.9156	.0514	.0001			
	5		.0017	.0200	.0353	.8479	.0941	.0010			
	6		.0071	.0336	.0602	.7380	.1540	.0071			
6	1			.0013	.0058	.0336	.7982	.1611			
	2		.0013	.0051	.0119	.0511	.7129	.2177			
	3		.0047	.0092	.0205	.0695	.6360	.2601			
	4			0	.0033	.0071	.8928	.0968			
	5			.0004	.0026	.0226	.8275	.1469			
	6			.0013	.0055	.0276	.9632	.0024			
7	1			.0023	.0025	.0131	.0825	.8921	.0075		
	2			0	.0003	.0023	.0318	.9640	.0016		
	3			.0004	.0008	.0056	.0437	.9406	.0089		
	4			.0006	.0024	.0086	.0648	.9057	.0179		
	5			.0002	.0004	.0017	.0123	.7877	.1975	.0002	
	6			.0003	.0006	.0015	.0099	.6505	.3356	.0016	
8	1							.0012	.9899	.0089	
	2							.0030	.9791	.0179	
	3							.0006	.8017	.1977	
	4							.0009	.6619	.3370	.0002
	5						.0012	.0032	.6059	.3877	.0020
	6						.0037	.0062	.6709	.3169	.0023
9	1						.0003	.0005	.0321	.8936	.0735
	2					.0001	.0004	.0015	.0364	.8852	.0764
	3						0	.0001	.0047	.7243	.2709
	4						.0001	.0003	.0083	.6828	.3085
	5					.0002	.0004	.0012	.0179	.6788	.3015
	6					.0005	.0007	.0019	.0207	.6017	.3745
10	1								.0009	.0107	.9884
	2								.0017	.0133	.9850
	3							.0003	.0025	.0155	.9817



NOTE: The points circled are the optimum alternatives in each state.

Figure 2.--Management income and standard deviation of income by supply of operating capital (states), Salinas Valley, Calif.

the alternatives which give the highest immediate income. Under this situation, a grower would accept a slightly lower farm income plan but one which has a higher variance. This means that to maximize long-term income, the alternative with the greater variance has a better chance of moving to a higher state. Sacrificing a higher current income for a crop plan with a lower income but higher probability of making a transition to a higher state in the future was found to be optimal in states 2 through 6. The optimal policy in states 7, 8, and 10 indicates that long-term income can be maximized by a crop plan on the efficiency frontier. In state 9, the optimal plan was very close to the frontier (see table 4).

Conclusions

These results would indicate that alternatives not located on the efficiency frontier must be included in an analysis when the objective is maximization of long term income. Second, analysis of problems in the Expected Income - Variance space must include capital explicitly as a third variable. Failure to include capital as a variable leads to unrealistic solutions. For instance, in the problem just described, failure to include capital supplies in the definition of the states would have resulted in always selecting an alternative that utilized the largest amount of capital possible as long as the return per unit of capital was positive. Third, as the supply of capital approaches the point where its MVP is near the marginal factor cost, less current income need be sacrificed to achieve a reasonable probability of making transitions to higher states.

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the alternatives which give the highest immediate income. Under this situation, a grower would accept a slightly lower farm income plan but one which has a higher variance. This means that to maximize long-term income, the alternative with the greater variance has a better chance of moving to a higher state. Sacrificing a higher current income for a crop plan with a lower income but higher probability of making a transition to a higher state in the future was found to be optimal in states 2 through 6. The optimal policy in states 7, 8, and 10 indicates that long-term income can be maximized by a crop plan on the efficiency frontier. In state 9, the optimal plan was very close to the frontier (see table 4).

Conclusions

These results would indicate that alternatives not located on the efficiency frontier must be included in an analysis when the objective is maximization of long term income. Second, analysis of problems in the Expected Income - Variance space must include capital explicitly as a third variable. Failure to include capital as a variable leads to unrealistic solutions. For instance, in the problem just described, failure to include capital supplies in the definition of the states would have resulted in always selecting an alternative that utilized the largest amount of capital possible as long as the return per unit of capital was positive. Third, as the supply of capital approaches the point where its MVP is near the marginal factor cost, less current income need be sacrificed to achieve a reasonable probability of making transitions to higher states.

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Table 4.--Optimal policy by state, 240-acre farm

State	Operating capital level	Alternative	Cropland
	dollars		percent
1	0	Bankruptcy	
2	7,500	Carrots (2)[a/]	30
		Sugar beets	20
		Small white beans	30
		Lettuce (5)	
		$300 flat rate	20
3	11,250	Carrots (2)	30
		Sugar beets	20
		Small white beans	30
		Lettuce (5)	
		$300 flat rate	20
4	15,000	Carrots (2)	20
		Sugar beets	20
		Small white beans	20
		Lettuce (2)	
		$135 guarantee	40
5	20,000	Carrots (2)	20
		Sugar beets	20
		Small white beans	20
		Lettuce (3)	
		$135 guarantee	40
6	27,500	Carrots (2)	15
		Sugar beets	15
		Small white beans	10
		Lettuce (3)	
		$135 guarantee	60
7	35,000	Carrots (2)	15
		Sugar beets	20
		Small white beans	15
		Lettuce (1)	
		Cooperative	50
8	55,000	Carrots (2)	15
		Sugar beets	15
		Small white beans	10
		Lettuce (1)	
		Cooperative	60
9	75,000	Carrots (1)	20
		Sugar beets	10
		Lettuce (1)	
		Cooperative	70
10	100,000	Carrots (1)	20
		Lettuce (1)	
		Cooperative	80

a/ Number in parentheses indicates contract number.