inferior growth of fibers and ovules, as compared with the liquid medium.

A series of experiments were conducted to investigate the effects (singly and interactions) of four classes of naturally occurring plant growth substances. The effect of gibberellic acid (GA) is shown in photo 3. As the concentration of gibberellic acid increased from 5×10^{-9}M to 5×10^{-6}M, the total fiber formed on cotton ovules increased. Both abscisic acid (ABA) and kinetin (K) inhibited fiber development at concentrations of 5×10^{-6}M and greater. Gibberellic acid largely overcame the inhibitory effect of ABA and K. Preliminary results indicate that indoleacetic acid (IAA) also promotes fiber development when supplied externally to the culture medium at concentrations of 5×10^{-6}M. The extent of growth promotion by GA and IAA, on ovules cultured in vitro, varies with the environmental conditions under which the parent plants were grown.

In a two week culture period, fiber length of ovules grown in vitro closely approximate that produced by intact plants grown in a glasshouse. As yet full elongation of fibers (at least one inch) has not been achieved. However, ovules have been cultured for 2½ months, with only one change of medium, and the embryos developed from the few-celled stage (2 days postanthesis) to mature seedlings. Photo 4 shows an intact seedling grown from the proembryo stage to a normal plant, entirely within a flask.

Ultimate goal

Cotton Incorporated initiated and continues to support this cotton fiber physiology program at the University of California, Riverside. The ultimate goal is to obtain information necessary to impose external controls for increasing yield and quality of marketable cotton fibers. The necessary procedures have been developed for culturing isolated cotton ovules from fertilization to maturity of the embryo. This accomplishment provides a working research tool to investigate the physiology and biochemistry of fiber development. The Cooperative State Research Service has recently made a grant to the University which will permit expansion of this research program.

C. A. Beasley, is Research Plant Physiologist, Irwin P. Ting is Associate Professor of Biology, and Leslie Ann Feigen is Research Assistant, Department of Biology, University of California, Riverside. *This research has been supported by Cotton Incorporated, 3901 Barrett Drive, Raleigh, North Carolina.*

ALTERNATIVES DRYLAND FARM

. . . other crops, and may—or may not worth the change

LELAND S. FREY

TO KEEP UP WITH the continuously changing conditions under which they operate, farmers need some way to examine and to evaluate the alternative uses for their land. For example, thousands of acres now used for dryland crops can be developed for irrigation. But will it pay to do it? This study was made to evaluate the alternative agricultural uses for land now being used for dryland farming. The study was based on an area in Tehama County where ir-

TABLE 1. ANNUAL COSTS PER ACRE WITH BARLEY GROWN EVERY OTHER YEAR, ALTERNATING WITH FALLOW, ON AN 80 ACRE LAND PARCEL

Yield per acre: 1,500 lbs

Cultural costs per acre*	$24.41
Harvest costs:	
Combine	5.00
Haul grain	1.13
Cash variable costs per acre	30.54
Cash fixed costs:	
Property taxes (2 years)	9.00
Insurance & incidentals (2 years)	4.50
Total cash costs per acre	44.04
Depreciation	-0-
Two years costs per acre	44.04
Annual costs per acre	$22.02
Added costs:	
Management @ 5% gross income	.79
Opportunity interest @ 5% Average investment	11.25
Total annual cost per acre	$34.06
Cost per CWT barley	$ 2.27

* Including the following operations: plowing, disking, harrowing, fertilization, planting, harrowing, spraying weeds; plus interest and miscellaneous costs.

TABLE 2. ANNUAL COSTS PER ACRE WITH GRAIN SORGHUM ON AN 80 ACRE LAND PARCEL, WITH ALL EQUIPMENT WORK DONE BY CUSTOM OPERATOR

Yield per acre: 4,000 lbs

Cultural costs*	$ 79.10
Harvest costs	
Combine	10.00
Haul grain	3.00
Cash variable costs per acre	92.10
Cash fixed costs:	
Property taxes	12.30
Insurance & incidentals	6.15
Total cash cost per acre	110.55
Depreciation	12.30
Annual cost per acre	$122.85
Added costs:	
Management @ 5% gross income	4.20
Opportunity interest @ 5% Av. Invest.	26.65
Total annual cost	$153.70
Cost per CWT	3.84

* Including the following operations: chiseling, disking, floating, fertilization, disking, harrowing, planting, spraying weeds, cultivating 3 times, irrigating 10 times, spraying insects; plus interest and miscellaneous costs.

TABLE 3. ANNUAL COST PER ACRE WITH CANNING OLIVES ON AN 80 ACRE LAND PARCEL WITH ALL EQUIPMENT WORK DONE BY CUSTOM OPERATOR

Yield per acre: 2½ tons

Cultural costs per acre*	$127.82
Harvest costs:	
Picking and hauling @ $130	325.00
Cash variable costs per acre	$452.82
Cash fixed costs:	
Property taxes	28.30
Insurance and incidentals	14.15
Total cash costs per acre	$495.27
Depreciation	28.30
Annual cost per acre	$523.57
Added costs:	
Management @ 5% of gross income	28.13
Opportunity interest @ 5% of Av. Invest.	46.65
Total annual cost per acre	$598.35
Cost per ton olives	$239.34

* Including the following operations: pruning, brush disposal, fertilization, shredding cover crop, irrigating 12 times, pest control; plus interest and miscellaneous costs.

TO ING

irrigation, –be

Going to the expense of shifting a parcel of land from dryland farming to the production of irrigated crops may—or may not be—profitable. In this study six alternative uses were compared for six parcels of land that were the same in every way except size. For ladino seed, canning olives, and irrigated pasture used either for growing out dairy heifers or the production of Grade A milk, the opportunity for profit improved as the size of the operation increased. On the other hand shifting from dry land barley to irrigated grain sorghum made a bad situation worse.

rigation water is available and where many landowners were considering developing their land and shifting it to the production of irrigated crops. In much of the area, the alternatives include only shallow-rooted crops because of claypans, hardpans, or other conditions that limit roots to the top 2 or 3 ft of soil. Most of the land parcels in the area are 20 to 40 acres or less in size, but there are quite a number ranging from 40 to 160 acres. Some parcels include 640 acres or more.

Because of the wide range in sizes of land parcels in the area, and because of the great influence of size of operation on returns, six sizes of land parcels were included in the study. The land parcels were from 20 to 640 acres and were similar in everything but size.

TABLE 4 ANNUAL COSTS PER ACRE WITH A GRADE A DAIRY ON AN 80 ACRE LAND PARCEL—WITH IRRIGATED PASTURE PROVIDING 70% OF ROUGHAGE REQUIRED
Milk production per acre, pasture producing 12½ AUM and yielding 11,500 lbs of milk per acre

	Annual cost per acre
Variable costs:	
Breeding fees 1.1 per cow @ 8.00	8.80
Tractor & truck work @ 2 hrs/cow @ 3.00	6.00
DHIA fees	4.00
Electricity & fuel	5.00
Repairs	6.00
Veterinary, fly spray, etc.	6.00
Miscellaneous supplies	6.00
Herd replacement, 25% culling, 2½% death	33.75
Alfalfa hay @ 2 tons/cow @ $25	50.00
Concentrates @ 1.5 tons/cow @ $60	90.00
Sub total	215.55
Labor @ 45 hours/cow @ 2.50	112.50
Sub total	328.05
Interest on operating capital @ 8% used ½ year	13.12
Miscellaneous costs @ 1%	3.28
Variable costs for dairy	344.45
Cultural costs on pasture	45.71
Variable costs for dairy and pasture	390.16
Cash fixed costs:	
Property taxes	27.61
Insurance and incidentals	13.80
Total cash costs per acre	431.57
Depreciation	39.27
Annual cost per acre	$470.84
Added costs:	
Management @ 5% of gross income	29.54
Opportunity interest @ 5% Average investment	50.50
Total cost per acre	$550.88
Cost per CWT milk	4.79

Estimates

Estimates were made of the capital requirements and anticipated costs and returns with 11 different agricultural uses for land limited to the production of shallow-rooted crops. Barley and oats and vetch grown together for hay were included because they can be grown without irrigation in this area. Where irrigation is available, and the land is properly prepared, crops such as grain sorghum, ladino seed, and sudan seed can be grown. With appropriate further development, crops such as olives or irrigated pasture are possibilities. Irrigated pasture, of course, can be used in a number of different kinds of livestock operations. The following crops were included in the study: (1) dryland crops, which included barley (every other year in fallow rotation), oats, and vetch hay; (2) irrigated crops, which included grain sorghum, red clover hay, ladino seed, sudan seed, canning olives, and irrigated pasture (rented for cash, used in growing Holstein dairy heifers, and used in production of milk sold for manufacturing purposes and Grade A milk with a contract for 75% Class I).

Factors of cost and yields were based on interviews with farmers who grow these crops within the study area. The land values used were based on studies made be the County Tax Assessor's office on actual sales of different sized pieces of this kind of land. The prices used in estimating returns are based on 10-year averages of prices shown in the Tehama County Agricultural Commissioners' reports for the years 1959–68.

Evaluating alternatives

In making the study the following method was used to evaluate the alternatives for a parcel of land: (1) an estimate was made for production costs for each alternative; (2) these estimates were used to determine the returns that may be anticipated for each alternative and (3) a comparison was made of the costs and returns for the different alternatives.

Production costs were estimated by a slight modification of the method developed by University of California Agri-

TABLE 5. CAPITAL INVESTMENT & ANNUAL COSTS & RETURNS WITH SELECTED ALTERNATIVE CROPS ON AN 80 ACRE PARCEL OF LAND

	Barley, crop every other year	Grain sorghum	Ladino seed	Olives canning	Irrigated pasture: Dairy heifers	Irrigated pasture: Grade A Milk 75% Class I
Investment per acre for an 80 acre parcel of land:						
Initial Cost	$225.00	$615.00	$615.00	$1,415.00	$709.00	$1,380.00
Average Investment	225.00	533.00	533.00	933.00	580.00	1,010.00
Annual costs & returns per acre:						
Yield	750 lbs/yr*	4,000 lbs	400 lbs	2½ tons	1 heifer	11,500 lbs milk
Price	@ 2.10	@ 2.10	@ 55¢	@ $225	@ $330	@ 4.45
Gross income	$15.75	$ 84.00	$220.00	$562.50	$330.00	$590.79†
Cash variable costs	15.27*	92.10	147.69	452.82	295.66	390.16
Gross net income	0.48	– 8.10	72.31	109.68	34.34	200.63
Cash fixed costs	6.75	18.45	18.45	42.45	19.78	41.41
Net cash income	6.27	–26.55	53.86	67.23	14.56	159.22
Depreciation	–0–	12.30	12.30	28.30	14.92	39.27
Net farm income per acre	$–6.27	$–38.85	$ 41.56	$ 38.93	$ –0.36	$119.95
Net farm income per $100 invested	$–2.79	$– 7.29	$ 7.80	$ 4.17	$ –0.06	$ 11.88

* Yield = 1,500 lbs /2 yrs (cropped every other year)
† Incl. Allowance $78.75 for ¼ cull cow and one calf
‡ $30.54 ÷ 2 yrs = $15.27

cultural Extension Service specialists. The methods used are shown in tables 1, 2, 3 and 4 (for barley, sorghum, canning olives and Grade A milk). Returns were measured in terms of net farm income by estimating the gross income and deducting all production costs except management and interest on the land investment. The method used to arrive at net farm income per acre and net farm income per $100 invested is shown in table 5.

In table 5, a comparison is made of the costs and returns for one dryland crop—barley—with five of the alternatives that would be available if the land were to be developed for irrigation.

The effect of land parcel size on capital requirements and on net farm income per acre and net farm income per $100 invested is shown in table 6.

Leland S. Frey is Farm Advisor, Sacramento County.

TABLE 6. CAPITAL REQUIREMENTS AND NET FARM INCOME FOR ALTERNATIVE CROPS ON LAND PARCELS OF DIFFERENT SIZES

	Barley crop every other year	Grain	Ladino seed	Olives canning	Irrigated pasture	
					Dairy heifers	Grade A milk 75% Class I
Initial cost per acre:						
20 acre land parcel	$300.00	$1,035.00	$1,035.00	$1,835.00	$1,193.00	$2,232.00
40 acre land parcel	225.00	745.00	745.00	1,545.00	854.00	1,661.00
80 acre land parcel	225.00	615.00	615.00	1,415.00	709.00	1,380.00
160 acre land parcel	175.00	515.00	515.00	1,315.00	606.00	1,146.00
320 acre land parcel	150.00	465.00	465.00	1,265.00	541.00	1,050.00
640 acre land parcel	125.00	415.00	415.00	1,215.00	491.00	971.00
Average investment per acre:						
20 acre land parcel	$300.00	$ 793.00	$ 793.00	$1,193.00	$ 871.00	$1,704.00
40 acre land parcel	225.00	623.00	623.00	1,023.00	677.00	1,177.00
80 acre land parcel	225.00	533.00	533.00	933.00	580.00	1,010.00
160 acre land parcel	175.00	458.00	458.00	858.00	503.00	866.00
320 acre land parcel	150.00	408.00	408.00	808.00	446.00	792.00
640 acre land parcel	125.00	358.00	358.00	758.00	396.00	728.00
Net farm income per acre:						
20 acre land parcel	$-10.98	$ -72.78	$ 5.69	$ 5.55	$ -52.65	$ 5.80
40 acre land parcel	- 7.23	-49.29	30.55	28.60	-13.01	82.74
80 acre land parcel	- 7.23	-38.85	41.56	37.93	- 0.36	119.95
160 acre land parcel	- 5.73	-33.47	46.94	44.31	5.52	151.30
320 acre land parcel	- 4.98	-31.97	48.44	45.81	8.47	157.73
640 acre land parcel	- 4.23	-30.47	49.94	47.58	9.95	161.78
Net farm income per $100 invested:						
20 acre land parcel	$- 2.86	$ - 9.71	$ 0.72	$ 0.47	$ - 5.93	$ - 0.34
40 acre land parcel	- 2.79	- 7.91	4.90	2.80	- 1.92	7.03
80 acre land parcel	- 2.79	- 7.29	7.80	4.07	- 0.06	11.88
160 acre land parcel	- 2.73	- 7.31	10.25	5.16	1.10	17.47
320 acre land parcel	- 2.68	- 7.84	11.87	5.67	1.90	19.92
640 acre land parcel	- 2.70	- 8.51	13.95	6.28	2.51	22.22

DIETHYLSTILBESTROL ON SUCKLING

MONTE BELL

Implanting suckling steer calves with 12 mg pellets of diethylstilbestrol (DES) resulted in weight gains of 22 lbs more by weaning time, and 42 lbs more by the end of the feedlot period, as compared with the controls. During marking and branding, 34 head of 114-day-old suckling steer calves were randomly assigned to either an implant, or control group. After weaning at 262 days of age, implanted and control cattle were fed for slaughter with all calves receiving 10 mg DES per day in the feed. The carcass weights and carcass weight-per-day-of-age of the implants (691 lbs and 1.43 lbs) were significantly greater ($P<.001$ and $P<.05$) than the controls (649 lbs and 1.34 lbs). Carcass measures and grades were similar for both groups except the implants had significantly ($P<.01$) more pounds of retail cuts per day of age than the controls (.68 vs. .65).

GROWTH STIMULANTS, principally diethylstilbestrol (DES), are used almost universally in California feedlots. A 1970 summary reports up to 24 lbs increase in weaning weights with 12 mg DES implants in suckling steer calves, but with variable postweaning effects. Locally, high producing cows on excellent range wean calves heavy enough to go directly into the feedlot. The effect of preweaning implants on postweaning gain is of concern to those feeding cattle for slaughter. This experiment was designed to test the effect of DES implants on preweaning and postweaning feedlot gains and carcass grades of steer calves.

On March 18, 1969, 114-day-old bull calves (½ Shorthorn, ¼ Angus and ¼ Hereford), weighing 329 lbs were castrated and individually weighed. Alternate calves were implanted with a 12 mg DES pellet. Birth dates and individual identification had been recorded previously by Glen Eidman of Nye Ranch, Glenn County.

After treatment, the calves were put back with their dams and all grazed the same native annual range pastures until weaning 148 days later. No supplement was fed during this period.

The calves were individually weighed at weaning and after three weeks preconditioning were shipped to a Nevada feedlot. There, in a common pen, all steers were fed a fattening ration which supplied 10 mg DES per head daily. The steers were not implanted at the feedlot. The animals were slaughtered in two lots on March 18 and March 25, 1970 with equal number of calves from each treatment in each slaughter lot. Carcass grades and measurements were made in Minch's Slaughterhouse, Red Bluff, by the regular USDA grader. Analysis of variance was computed on the data.

Table 1 shows the preweaning and postweaning gains. The implanted calves gained 2.22 lbs per day to weaning and 2.51 lbs per day from weaning to slaugh-