ranking for slaughter weights and carcass measurements. Line *C* cattle weighed 87 lbs more than line *D* cattle at slaughter time. This much difference on today's market would be worth about $18 based on a price of $0.21 for good grade beef. The 57-lb difference in slaughter weight between line *A* and *D* was not statistically significant. Taken at face value it would be considered economically important by the seller, because it is equivalent to $12 per head. The quality grade averaged high-good for each line, and the differences between lines were very small.

If $0.34 is used as the price of good grade carcass beef, the same differences in value occur between line *C* and *D* carcasses and between line *A* and *D* carcasses as occurred among the live animals at $0.21. Differences in dressing per cent among the three lines were small and not statistically significant.

Line *D* carcasses tended to be more muscular and less wasty than carcasses of lines *C* and *A*. The thickness of fat was less in line *D* carcasses than in line *A* carcasses, and the area of rib eye per 100 lbs of carcass weight was greater in line *D* carcasses than in either line *C* or *A* carcasses. Hence, line *D* carcasses had a better yield grade (cuttability) than either line *A* or *C* carcasses. They also had a higher percentage of carcass weight in the form of boneless, closely trimmed meat in the round, loin, rib and chuck.

In the final analysis, all carcasses were adjusted to low choice quality grade. Line *C* carcasses yielded an average of 23 lbs more beef of low choice quality in the form of boneless, closely trimmed meat in the round, loin, rib and chuck than line *D* carcasses. At $0.70 per lb this difference is worth $16. Line *A* carcasses were worth about $5 more than line *D* carcasses. Before adjusting for grade and cuttability, the difference in value between lines *A* and *D* carcasses was $12.

In summary, the results showed line *D* produced carcasses that ranked lowest in value, but best in cuttability; line *A* carcasses ranked intermediate in value, but poorest in cuttability; while line *C* ranked highest in value and intermediate in cuttability.

The three lines *A*, *C* and *D* showed large and statistically significant differences in slaughter weight, cutability, and percentage of boneless, closely trimmed retail cuts from round, loin, rib and chuck. Differences in carcass quality grade were negligible. Thus, it appears that size, cuttability and yield of boneless, closely trimmed retail cuts from round, loin, rib and chuck can be improved through selection without impairing carcass quality grade.

Wade C. Rollins and Floyd D. Carroll are Professors in the Department of Animal Husbandry and Animal Husbandmen in the Experiment Station, University of California, Davis.

RANKING OF THREE LINES ON BASIS OF AVERAGE PERFORMANCE OVER THREE CALF CROPS*

Trait	First	Second	Third	Statistical significance of pair comparisons
(1) Weaning weight (lb)	C (541)**	A (517)	D (510)	None
(2) Slaughter weight (lb)	C (1092)	A (1062)	D (1005)	C > D†
(3) Warm carcass weight (lb)	C (678)	A (656)	D (624)	C > D
(4) Dressing percentage	D (62.5)	C (62.2)	A (61.9)	None
(5) Kidney and internal fat (per cent of carcass weight)	D (2.7)	C (2.8)	A (2.9)	None
(6) Fat thickness (in.)	D (0.41)	C (0.46)	A (0.51)	D > A
(7) Rib eye area (sq. in.)	D (12.1)	C (12.0)	A (11.7)	None
(8) Rib eye per cwt. of carcass (sq. in.)	D (1.96)	A (1.80)	C (1.75)	D > A D > C
(9) Marbling score	C (8.3)	D (7.9)	A (7.5)	None
(10) Quality grade	C (18.2)	D (18.0)	A (17.9)	None
(11) Yield grade (cuttability)	D (2.94)	C (3.32)	A (3.43)	D > C D > A
(12) Per cent of boneless closely trimmed retail cuts from round, loin, rib and chuck	D (51.0)	C (50.1)	A (49.8)	D > A
(13) Per cent of boneless closely trimmed retail cuts from round, loin, rib, and chuck, equivalent to low choice quality (carcass index)	D (50.2)	C (49.5)	A (49.0)	D > A
(14) Pounds of boneless closely trimmed retail cuts from round, loin, rib and chuck, equivalent in quality to low choice	C (335.3)	A (319.9)	D (312.2)	C > D

* Lines B and E are excluded since they were not involved in all three calf crops.
** Line average over three calf crops.
† ">" implies a statistically significant superiority.

SALT

Safflower is highly salt tolerant, according to results of field plot experiments in 1962 and 1963. However, safflower appears to be only about half as salt tolerant during germination as during later stages of growth. Salinity decreases the oil percentage of the seed, but oil quality is unaffected.

DURING THE LAST few years the culture of safflower in California has expanded rapidly. Some of the areas in which this oil crop is grown are affected by salt, and this has prompted salt-tolerance investigations at the United States Salinity Laboratory and the University of California at Riverside in 1962 and 1963. The effects of soil salinity on germination, vegetative growth, seed yield, and oil production and quality were determined.

1962 experiments

Four varieties, N-10, US-10, Gila, and a variety designated as 41191197 which was developed by a commercial company, were planted in late March, 1962, according to Latin square design in four 14-foot square plots. Double-row sloping seedbeds on 42-inch centers were used with 36-inch subplots for each variety. Superphosphate at the rate of 66 lbs of P per acre was worked into the soil prior to bed formation. Calicum and potassium nitrates were added in each irrigation for a total application of 240 lbs of N and 315 lbs of K per acre.

Differential salination was initiated approximately three weeks after planting when the plants were in the four-leaf stage. Salt levels were increased stepwise during the next two weeks until the series of plots were receiving 0, 3,000, 6,000, and 9,000 ppm of added salt (equal parts of NaCl and $CaCl_2$) in the irrigation water. The initial salinity of the irrigation water was about 350 ppm. The average soil salinities in the root zone of the four plots, expressed as the electrical conductivity of the saturation extract (EC_e), were 0.9, 4.7, 7.9, and 11.2 millimhos per centimeter.

Within a month after initial salination,

TOLERANCE OF SAFFLOWER

L. E. FRANCOIS • D. M. YERMANOS • LEON BERNSTEIN

leaves on the saline plots were noticeably smaller, thicker, and darker green than the control-plot leaves. These effects were more pronounced with increased salinity.

Plant height and stem diameter decreased progressively with increasing salinity. Relative height reduction was similar for all varieties, but Gila and 41191197 showed greater decrease in stem diameter than the other two varieties. Reduction in vegetative growth closely paralleled reduction in seed yield.

Flowering was accelerated by salinity, with the high-salt plot flowering about three days earlier than the control. Salinity had a much greater effect on maturation. Each salinity increment hastened final maturation by approximately one week so that the high-salt plot matured three weeks earlier than the control.

Absolute and relative seed yields for each plot were analyzed statistically to determine any significant varietal differences. On a relative basis, varietal differences were significant only on the high-salt plot. This was attributable to the low relative yield of Gila (fig. 1).

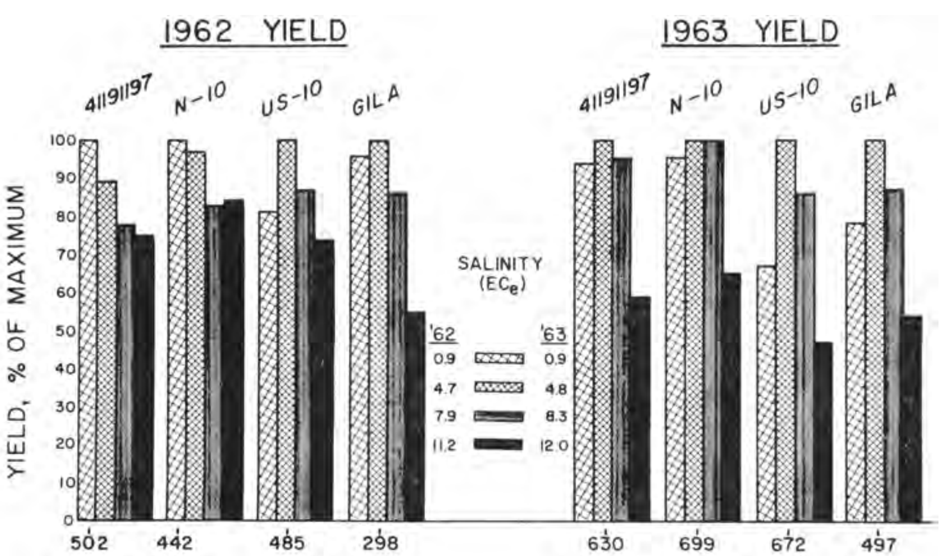
Yield data

A salinity of 11 mmhos/cm (EC_e) caused only a 20 to 25% decrease in yield, except for Gila. Safflower would thus appear to be highly salt tolerant, ranking just below cotton in this respect.

Salinity reduced seed yields by decreasing both the number of flowering heads and the yield of seed per head. The latter factor predominated. Salinity caused a decrease in average seed weight, and this was responsible for the decrease in seed yield per head. The number of seeds per head remained fairly constant at all salinity levels.

A laboratory germination study showed that salinity delayed initial emergence and decreased the subsequent rate of emergence. Higher salinities also reduced ultimate germination percentage. A doubling in average emergence time for all varieties occurred at 6.8 mmhos/cm (EC_e). Since a 50% reduction in growth and yield occurs at about 12 mmhos/cm, safflower appears to be only about half as salt tolerant during germination as during later stages of growth.

FIG. 1, SEED YIELDS FROM SALINIZED FIELD PLOTS



MAXIMUM YIELDS IN GRAMS SEED PER SUBPLOT
Multiply by 9.15 to get lbs. seed per acre.

Since this crop is grown primarily for its oil, the effects of salinity on oil production are of special importance. The yield of oil per acre dropped by 25 to 60% in the high-salt plot compared to the maximal oil yields for each variety in this experiment. N-10 showed the smallest decrease and Gila the largest. Not only did salinity reduce yield of seed, but the oil percentage in the seed was also reduced. The rate of loss in oil percentage with increasing salinity was essentially uniform over the whole salinity range, and the average oil percentage dropped from 38.4% for the control plot to 34.0% for the high-salt plot. For each millimho/cm increase in EC_e, the average oil percentage for the four varieties decreased by about 0.4 percent-units.

Seed heads

The analysis of seed heads produced on different branches of the safflower plant revealed one of the main causes for the reduction in oil percentage by salinity. The main stem of a safflower plant terminates in a flower that develops into the primary seed head. Lateral branches terminate in secondary seed heads and produce tertiary heads on branches below the secondary head. Under nonsaline conditions, seeds from primary heads have a higher percentage of hull and a lower oil percentage than seeds from the secondary heads, and tertiary heads have the highest oil percentage of all (fig. 2). Salinity increases the hull percentage and decreases the oil percentage in all heads, but the effect is greater in the secondary and tertiary heads than in the primary. As a result, under saline conditions, the primary heads tend to have higher oil percentages than the secondary and tertiary. Thus, salinity causes a decrease in oil percentage largely by increasing the hull percentage of the seeds.

The analysis of the different head types in safflower indicates several factors that are important for seed sampling. At all salinity levels the primary heads have the highest hull percentages and the tertiary heads the lowest. The primary heads also have the largest seeds and the tertiary have the smallest. Salinity decreased seed size for all types of heads but the greatest decrease in seed weight occurred in the tertiary heads. Seed sampling of safflower plots must take into account not only the different characteristics of the head types, but also the differential effects of salinity on the seed in the different head types.

Soil salinity did not affect the chemical composition of the oil, but it depressed the protein content of the seed by amounts ranging from 0.2% in 41191197 to 3% in US-10. In the high-salt plots the protein content of the seed was 18.99% in N-10, 18.40% in US-10, 16.93% in Gila, and 17.99% in 41191197.

1963 field plots

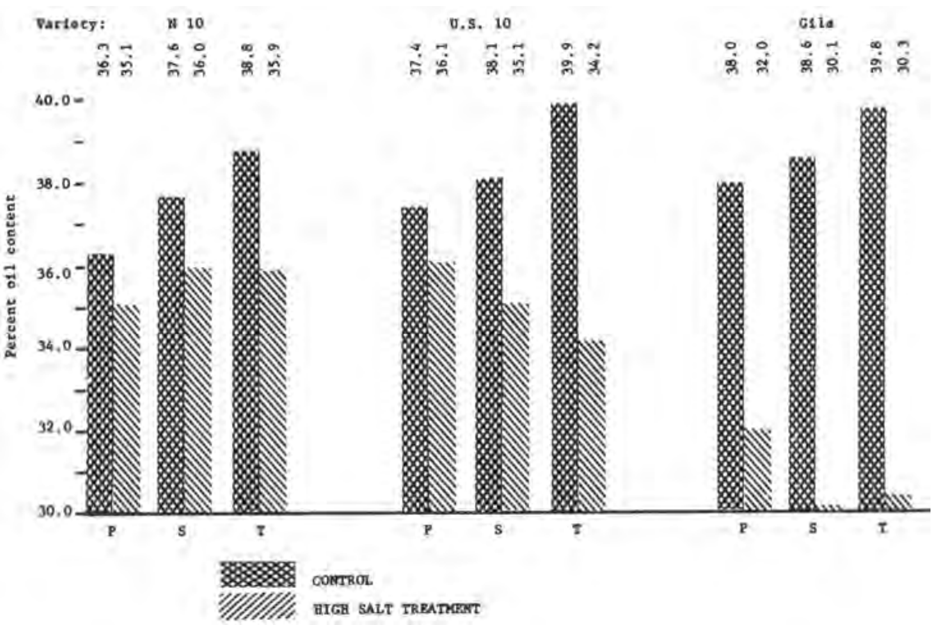
The field plot experiment was repeated in 1963 using the same methods employed in 1962 except that the plots were planted in late February, and the salt levels of the irrigation water were 0, 4000, 8000, and 12,000 ppm of added salts.

In 1962, varieties differed significantly in relative reduction of stem diameter but not in reduction of plant height. In 1963, significant varietal differences occurred only with respect to reduction in plant height. US-10 and N-10 were affected more than the other two varieties. The average reduction in height for the four varieties in the high-salt plot was 40%. Because of the earlier planting date, maximum seed yields in 1963 averaged 45% greater than in 1962. Low salinity stimulated seed yields more in 1963 than in 1962. As in 1962, a 25% decrease in yield occurred at 11 mmhos/cm (EC_e). A sharp decrease in yield occurred on the high-salt plot at 12 mmhos/cm. Safflower, although quite tolerant to moderate salinities, cannot tolerate higher salinities of 10 to 15 mmhos/cm as well as cotton. US-10 and Gila were more affected by moderate and high salinity than 41191197 and N-10, which is in agreement with similar trends on the high-salt plot in 1962. Oil percentages for control-plot seeds were 2% lower than in 1962 (36.4% instead of 38.4%). Oil percentage was not appreciably affected at the low-salt level in 1963, but at higher salinities, the effects were comparable for the two years.

L. E. Francois is Agronomist, and Leon Bernstein is Plant Physiologist, U. S. Salinity Laboratory, Riverside; D. M. Yermanos is Assistant Professor, Department of Agronomy, University of California, Riverside.

This study is part of the research being conducted by the Salinity Laboratory, United States Department of Agriculture, Riverside, California, and the University of California at Riverside.

FIG. 2, OIL CONTENT OF SAFFLOWER SEED IN CONTROL AND HIGH-SALT PLOTS



Oil content of safflower seed from primary (P), secondary (S) and tertiary (T) heads of safflower from the varieties N-10, US-10, and Gila in the control and high-salt plots, 1962.

SLOPING For Beef Feed

MANAGEMENT OF MANURE has been called the number one technical problem facing the livestock industry today. As the degree of confinement of animals becomes greater, the problems are intensified. The use of sloping floors in feed lots had been suggested as a possible solution to the collection aspect of manure management. The movement of cattle was expected to cause manure to be moved toward the lower end of a sloping floor and pushed off. This would result in a self-cleaning floor, with ultimate manure collection in an area where further movement by loader or conveyor system could be accomplished easily. However, studies were also needed on possible adverse effects on cattle held on floors with a slope sufficient for self-cleaning. Tests reported here were initiated recently at the Imperial Valley Field Station to investigate the effect of slope on both manure removal and animal behavior.

Pen construction

Three identical 12 × 14-ft pens with tiltable concrete floors were constructed. The pen floors were tilted to angles of 1.25, 4.75, and 7.0 degrees from horizontal. An adjacent pen of the same size with a natural (dirt) floor was also used. All pens were under a 10½-ft-high hay