of the Christmas trade. Dieback of large limbs in many orchards was a serious problem, until station researchers found that irrigation in the dormant (winter) season would solve it. Irrigation and fertilizer regimes and also pest control programs were developed.

Air pollution research to determine the effects of smog on plants was initiated in 1951 by staff members at the Riverside station. Perhaps the first diagnosis of plant injury by air pollution in the South Coast Air Basin was made by a staff member in the early 1940s. In the early stages of air pollution research, ozonated olefins were believed to be the agents principally responsible for plant injury in the basin. However, later research results showed that ozone and peroxyacyl nitrate (PANs) were the phytotoxic substances and that the PANs were important eye irritants. The peroxyacyl nitrate compounds were first detected, identified, and used experimentally at Riverside. Extensive studies have revealed highly significant reductions in crops of navel oranges, lemons, grapes, and cotton growing in polluted areas. Continuing experiments indicate that crop reduction due to oxidant pollutants may extend to sweet corn, alfalfa, tomato, strawberry, chili pepper, and probably to other crops. Air pollution damage also occurs on several ornamental plants and on pine trees growing in nearby mountains.

Pioneering work showed that repeated exposure to hydrogen fluoride concentrations in the range of 1 to 2 parts per billion could suppress citrus tree growth, reduce fruit production, and, in some instances, produce visible leaf symptoms. One result of this research was development of fluoride emission controls by specific industries.

Investigations of the contribution of agricultural waste burning, range burning, and disposal of forest waste to the overall air pollution problem have shown that while the soiling properties of the smoke and the obscuring of visibility from these operations are objectionable, the smoke's contribution of precursors of smog and generation of toxic substances is minimal.

Research on vitamin D during the past decade at the CRC-AES has resulted in phenomenal developments in understanding this vitamin's biochemical mode of action. Fat-soluble vitamin D is essential to higher animals to ensure their adequate absorption of dietary calcium, which is necessary for normal development of the skeleton; otherwise, the rickets disease ensues.

Basic studies in biochemistry revealed that the molecular form of vitamin D (active in the intestine) which stimulates calcium absorption is produced only after two successive structural modifications of the parent vitamin D. Both involve hydroxylation: the first occurs in the liver to give 25-hydroxy-vitamin D and the second in the kidney to yield the hormonally active form, 1,25-$(OH)_2$-D_3. This latter compound, after its production by the kidney, migrates to the intestine. There it localizes in the nucleus of the cell to mobilize genetic information required for elicitation of the typical vitamin D-related biological responses, including stimulation of intestinal calcium transport.

This new information has profound medical implications. It is now known that people develop uremia or chronic kidney failure because of diseased kidneys, which cannot produce the vitamin D metabolite (1,25-$(OH)_2$-D_3) necessary to prevent these lesions. This compound now has been synthesized on a large scale, and it has been clinically evaluated on uremia and other diseases related to vitamin D deficiency.

Two staff members were elected to the prestigious National Academy of Sciences as the result of basic research they performed while at the station: the late Dr. Walter P. Kelley, Soil Chemistry, 1942, and Dr. Robert L. Metcalf, Insect Toxicology and Physiology, 1967.

A tangible measure of an institution's scientific accomplishments is the quantity and quality of publications reporting its research results. About 35 major books or monographs have been published by station staff members. No tally has been made of the station's technical publications in recognized scientific journals. However, it is estimated that the station's total contributions since its founding in 1907 greatly exceed 5,000 in the scientific journals, various University of California publications series (*Hilgardia*, bulletins, and circulars), *California Agriculture*, semi-technical agricultural and other trade journals.

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HYBRID GRAIN

TO EVALUATE the relative merits of grain sorghum hybrid cultivars and their interaction with environment, seven hybrids were grown in comparison with two established varieties (Meloland and D.D. 38) and one experimental variety in trials conducted at the Imperial Valley Field Station. The trials were planted April 15, June 1, and July 15 in each of five years, 1962 to 1967, on 40-inch beds with five replications. Cultural practices were typical for the Imperial Valley area, except plants were hand-harvested.

Emergence time was the same for varieties and hybrids, with the June and July plantings emerging one to two days sooner than the April plantings. Days from planting to flowering varied among cultivars and planting dates. They range from 69 days for RS 610 to 77 days for Meloland, 55 days for DeKalb C44b to 69 days for Paymaster Apache, and 54 days for DeKalb C44b to 64 days for IV 581400 for April, June, and July plantings, respectively. The average of all cultivars was 73, 63, and 60 days for April, June, and July plantings, respectively, decreasing as planting was delayed except for RS 610 and NK 210 which flowered earlier at the June planting than the July planting. The greatest difference was between the April planting date and the June and July plantings. Cultivars, date of planting, and cultivar by planting date interaction were significant at the 5% level.

Cultivars accounted for the major differences in plant height. Planting date

SORGHUM TRIALS

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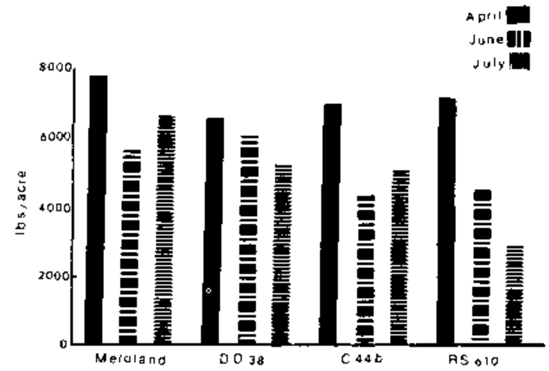
had little effect and was not significant. The average of all cultivars was 47, 48, and 48 inches for April, June, and July plantings, respectively. There was a significant difference at the 5% level between cultivars, with a range of 41 inches to 49 inches, 46 inches to 50 inches, and 44 inches to 55 inches in April, June, and July plantings, respectively. The interaction between cultivars × date of planting was significant at the 5% level. Cultivars IV 581400, A-14, and Double Dwarf 38 were shortest when planted in April and other cultivars decreased significantly in height as planting was delayed.

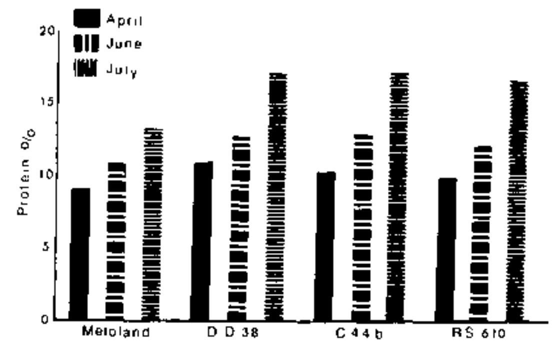
Crude protein (see table) ranged from 9.1 to 17.9%, with the greatest differences between planting dates. All cultivars increased in protein as planting was delayed, with an average of 10.2, 12.5, and 16.1% for April, June, and July plantings, respectively (graph 2). Meloland and IV 581400, a sib of Meloland, had the lowest protein at all planting dates and Apache the highest.

Both planting dates and cultivars influenced production. The interaction between these two factors was also significant. In general, yields decreased as planting was delayed (see table). Also, yield differences between cultivars increased as planting was delayed. The cultivars fell into two general patterns, highest yield in April and lowest yield in June (Meloland and DeKalb C44b), and decrease in yield as planting was delayed (Double Dwarf 38 and RS 610) (graph 1). Production varied between years, from an average yield of 6,214 lbs per acre in 1963 to 4,826 lbs per acre in 1967 for all cultivars and planting dates. The years and interaction between cultivars times years were significant at the 1% level. Generally, the hybrids and varieties yielded equally well when planted in April, but the varieties had a definite advantage in the June and July plantings.

Crude protein production per acre ranged from 499 lbs (RS 610 planted in July) to 913 lbs (D.D. 38 planted in July), with all cultivars averaging 717, 606, and 691 lbs for April, June, and July plantings, respectively. Production between cultivars varied more as planting was delayed. The difference in yield between the highest-producing and lowest-producing cultivars for April was 97 lbs; the corresponding figures for June and July were 282 and 463 lbs. Grain yield and crude protein production showed a slight correlation of .66.



GRAPH 1. GRAIN YIELD (5 YEAR AVERAGE) OF 5 GRAIN SORGHUM CULTIVARS PLANTED IN APRIL, JUNE, AND JULY AT THE IMPERIAL VALLEY FIELD STATION



GRAPH 2. CRUDE PROTEIN (5 YEAR AVERAGE) OF 5 GRAIN SORGHUM CULTIVARS PLANTED IN APRIL, JUNE, AND JULY AT THE IMPERIAL VALLEY FIELD STATION

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GRAIN YIELD AND PROTEIN PERCENT OF 10 GRAIN SORGHUM CULTIVARS GROWN AT THE IMPERIAL VALLEY FIELD STATION FROM 1962 TO 1967

	Planting date				Planting date			
Cultivar	April	June	July	Ave.	April	June	July	Ave.
		Yield lbs/A				% Crude protein		
Meloland	7810	5720	6660	6730	9.2	11.1	13.4	11.2
Double Dwarf 38	6580	6050	5310	5980	10.9	12.8	17.2	13.6
IV 581400	7530	5930	5950	6570	9.1	10.8	13.5	11.1
Paymaster Apache	6370	3510	2530	4130	11.1	14.1	17.9	14.4
Pfister PAG 515	7050	4530	3260	4950	10.9	12.9	16.1	13.3
Advance A-14	6300	4710	4750	5250	10.6	12.9	15.4	13.0
Lindsey 744	7030	4610	3130	4920	10.5	12.7	16.6	13.3
RS 610	7220	4550	2940	4900	9.9	12.3	16.9	13.0
Northrup King 210	7190	4500	3280	4990	9.8	12.1	16.7	12.9
DeKalb C44b	6950	4400	5120	5490	10.4	12.9	17.4	13.6
Average	7003	4851	4293	–	10.2	12.5	16.1	–
LSD 5% level		Cultivars		Date planted		Cultivar × planting		
Yield—lbs/A		743		842			989	
Protein—%		0.89		3.10			0.97	