Manures are good sources of phosphorus

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Animal and poultry manures are often evaluated on the basis of their nitrogen content. Field experiments in the Antelope Valley on producing alfalfa fields have shown that poultry, steer, and dairy manure are also good sources of phosphorus. In this study, yield comparisons were made between treble superphosphate and manures when applied in amounts to provide the same rates of phosphorus as conventionally used on alfalfa.

TESTS WERE CONDUCTED over a one-year period to measure the residual effects of manures on alfalfa yields as well as the phosphorus content of alfalfa produced. Two sites in the Antelope Valley, Los Angeles County, were selected for the study and replicated plots were laid out large enough in size to allow harvesting with regular farm equipment. Hay yields were measured by the weight of the bales produced from each treatment.

The first test was conducted at the Kelly Brothers ranch near Lancaster. Initial applications included 4 tons of steer manure, 4 tons of poultry manure, and 400 lbs of treble superphosphate per acre. These materials were broadcast during the winter of 1959–60 on a three-year-old stand of Lahontan alfalfa. Each treated area was four-fifths of an acre and all treatments were replicated three times. The chemical analyses of the manures tested in this study are shown in table 1. It should be noted that the steer manure, which had come from a local feed lot, contained less than half as much phosphorus as did the poultry manure.

TABLE 1. ANALYSES OF MANURES USED*

Material	Organic matter	N	P	(P_2O_5)	K
Chicken manure	57.7	3.1	1.31	(3.00)	0.7
Steer Manure	48.5	1.3	0.50	(1.15)	2.4

* N, P, K expressed as per cent of dry weight

After the third year, the fertilizer treatments were reapplied to the superphosphate and chicken-manure plots. The plot which had received 4 tons of steer manure earlier was changed to a light rate of superphosphate, and results recorded for two additional years.

Data for the entire five-year period of the experiment are shown in table 2. These would indicate a slightly higher yield from poultry manure than from treble superphosphate although the differences were not statistically significant in any one year. In this comparison over the whole period, 40 to 50 lbs of extra hay were produced for each pound of phosphorus, from either the superphosphate or from chicken manure. The light rate of phosphorus in the steer manure produced relatively better yields per unit of phosphorus than did the other materials. This same plot, retreated with treble superphosphate after the third year, showed a hay increase of 120 lbs per pound of phosphorus during the last two seasons.

Plant analysis

Plant analysis was used to further evaluate the phosphorus response in the Kelly test. Alfalfa plants were sampled at each cutting. The graph shows the relationship between yield for the 1960 season and the phosphate-phosphorus of the mid-stems of alfalfa at each of the four cuttings. The 80 lb-per-acre rate of phosphorus (180 lbs of P_2O_5 per acre) obtained from the chicken manure and treble superphosphate applications gave about the same hay yield and phosphate-phosphorus content. Plants in both treatments were adequately supplied with phosphorus and gave near-maximum yields. The steer manure treatment, supplying only 30 lbs of phosphorus per acre produced a slightly lower yield and lower phosphorus content in the alfalfa.

Results from the steer manure trials led to a second experiment in 1961 using dairy manure from a commercial dry-lot operation in the Los Angeles area. Dairy manure was furnished by the Dairymen's Dairy Manure Fertilizer Cooperative of Artesia. In this experiment, 4½ and 9 tons of dry dairy manure were worked into the soil prior to planting Lahontan alfalfa. These amounts of manure provided 78 and 156 lbs of phosphorus per acre respectively. Treble superphosphate applications were made to provide the 78-lb rate as broadcast on the surface—and a double rate worked into the soil. After two years, additional dairy manure was broadcast, on the surface, in each of the

TABLE 2. YIELD OF ALFALFA AS INFLUENCED BY MANURES AND SUPERPHOSPHATE APPLICATIONS
Kelly Brothers Ranch

Fertilizer treatments			Tons of hay harvested					5-year Summary	
Material applied	P/Acre	(P_2O_5)	1960	1961	1962	1963	1964	Total Tons	Extra hay per lb P
None	...	...	9.0	9.8	8.8	7.8	7.0	43.2	...
4 T steer manure	30	(70)	9.7	10.4	8.6	...	...	...	73
200 lb treble superphosphate	40	(90)	...	...	...	8.8*	8.4	...	120
2 × 4 T chicken manure	160	(360)	10.0	10.7	9.2	9.0†	8.4	47.3	51
2 × 400 lb treble superphosphate	160	(360)	10.0	10.6	8.7	8.9†	8.2	46.4	40
LSD 5%			.4	.1	.6	.4	.6		

* Source of P changed to 200 lbs treble superphosphate.
† Chicken manure and 400 lbs treble superphosphate reapplied in 1963.

TABLE 3. YIELD OF ALFALFA AS INFLUENCED BY MANURE AND SUPERPHOSPHATE APPLICATIONS
Erwin Fink—Antelope Valley Ranch

Fertilizer treatments			Tons of hay harvested				Tons/acre 4-year total	Extra hay per lb P
Material applied	lb/acre	(P_2O_5)	1961	1962	1963	1964		
None	..	..	6.7	6.99	6.8	5.6	26.0	..
2 × 4½ T Dairy Manure (½ in and ½ an)	78	(180)	7.4	7.2	7.9*	6.9	29.4	82
2 × 9 Tons† Dairy Manure (½ in and ½ on)	155	(360)	7.9	8.1	8.5*	7.9	32.4	82
2 × 400 lb treble super both on surface	156	(360)	8.0	8.1	8.7*	7.3	32.1	78
1 × 300 lb treble super all worked in	156	(350)	8.4	8.2	8.0	6.7	31.3	67
L.S.D. 1%			.5	.4	.5	.5		

* Surface broadcast (reapplication).
† Worked into seedbed prior to planting (initial application).

manure-treated plots, and additional treble superphosphate broadcast where the light rate had been broadcast initially.

This second test was located at the Fink Ranch on the west side of the Antelope Valley. Each plot was one-third acre in size and there were four replications of each treatment. Results the first season showed slightly higher yields from the high rate of treble superphosphate than from the dairy manure. However, as the experiment continued, yields from the animal manure treatments improved, particularly at the higher rate (19 tons) of broadcast application. Results over a four-year period (see table 3) indicate that about 80 lbs of hay were produced from each pound of fertilizer phosphorus applied from the dairy manure. An equivalent yield was possible where broadcast applications of phosphorus (from treble superphosphate) had been made. The heavy initial application of superphosphate worked into the soil was not quite as effective as the experiment continued.

Results of these two alfalfa fertilizer tests in the Antelope Valley indicate that animal manures and poultry manures can be used in alfalfa production and that they give continued phosphorus responses equal to, or slightly better than, those obtained from commercial phosphorus materials. No attempt is made in this study to evaluate costs. Nothing in the data suggests that application of manure justifies an appreciably higher price per unit of phosphorus than would be paid for superphosphates.

Manures in this study did at least as well as commercial phosphorus and appear to have a definite place in phosphorus-deficient areas. If manures can be transported and applied to the land at favorable costs it would seem worthwhile to explore the possibility of utilizing the large resources of manures from poultry farms and dairy or beef feed lots in southern California as a means of building up some of the phosphorus-deficient soils in nearby valleys. It would also seem possible that grass crops such as sudan or sorghum might precede the alfalfa to allow some return for the large amounts of nitrogen which come with the phosphorus in the initial manure applications—and let the residual build-up of soil phosphorus help alfalfa crops which could then follow.

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GIBBERELLIN RESEARCH WITH CITRUS

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Gibberellic acid is registered and recommended in California for certain uses (particularly in delaying rind and fruit maturity) on navel oranges and lemons. Favorable responses have also been obtained on limes and mandarins, but our present knowledge is insufficient to warrant registration or recommendation for use on these fruits. So far, we do not know how to take advantage of the delayed softening and aging of Valencia orange and grapefruit rind tissue without obtaining considerable regreening. The influence of GA_3 on retention of young fruit has potential value, but no practical method has yet been devised to avoid phytotoxic responses.

GIBBERELLIC ACID (GA_3) is the commercially available member of a family of naturally occurring compounds. Very low concentrations of these compounds possess biological activity capable of regulating plant growth. The influence of GA_3 on citrus has been the subject of extensive field and laboratory research in California during the past eight years. When GA_3 is applied to nearly mature green-colored citrus fruit there is a considerable delay in loss of green chlorophyll pigment from the rind. In lemons and limes, this reflects a delay in fruit maturity, but for grapefruit, mandarins, and both navel and Valencia oranges, the effect appears to result from a delay in certain aging processes of the rind.

Lemons and limes

Preliminary trial applications of GA_3 to lemons and limes in 1956 indicated that it might be effective in increasing fruit set or retention in these and other varieties of citrus. Although increased retention occurs when GA_3 is applied to branches, to individual flower clusters, or to small fruit, phytotoxic effects occur when GA_3 is applied to entire trees during bloom.

The natural pattern of lemon and lime fruit maturity is for much of the fruit to color and ripen prior to the demand for fresh fruit that develops during hot summer weather. GA_3 sprays delay the maturity of lemon and lime fruits—providing greater flexibility in harvesting and marketing. In some trials, this delay in fruit maturity has eliminated the early harvest, which is predominately undesirable, small, tree-ripe fruit. GA_3 has been registered and recommended for use on lemons since November 1963, but registration has not yet been obtained for limes.

Mandarins

Poor fruit set is a problem in the Clementine (Algerian) mandarin wherever it is grown. In previous trials (1958), applications of GA_3 at 1,000 ppm to flowers in full bloom on Clementine trees resulted in increased fruit set. The GA_3-treated fruits were significantly smaller—probably because they were also seedless. Since the self-incompatibility of this variety can be somewhat overcome by interplanting other citrus varieties, and since spraying entire trees during the flowering season has phytotoxic results, very little additional research has been performed. The potential of GA_3 to