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THE USE OF A MIXTURE OF 50 PERCENT GRAPE POMACE AND 50 PERCENT WHOLE OLIVE MEAL AS A PORTION OF A FORCE MOLT RATION

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With the prices of traditional feed ingredients spiralling, interest is increasing in the possibility of using alternative feedstuffs to lower costs. In California, a number of waste products with potential feeding value are available from the state's food processing industries. Unfortunately, little is known about their composition or nutrient quality.

Proximate analysis of a feedstuff provides information on crude protein, fiber, fat, nitrogen-free extract, ash and moisture at a relatively small cost. But more detail is required. Chickens have specific requirements for certain amino acids, minerals, and vitamins. If any one of these essential nutrients is in short supply, performance of the bird is limited.

Detailed chemical analyses are expensive. A less costly method for screening new feed sources is through the use of "dilution trials" in which increasing amounts of the alternative feedstuffs are added to a well-formulated feed. This approach does not identify the limiting nutrient, but it does determine the maximum use level and the potential for economic savings.

The study reported here was undertaken to test the possibility of substituting a mixture of 50 percent grape pomace and 50 percent whole olive meal for a portion of the force molt ration. The dilution trial approach was used.

EXPERIMENTAL DESIGN

Kimber White Leghorn hens, ready for molting, were selected from an environmentally controlled house and were randomly caged on both sides of one aisle of a house with rows 48 feet long. The cages were 8 inches wide with 2 hens per cage. Each plot was 8 cages long, housing 16 hens. The treatments were replicated in a randomized block design with 3 replicates or 48 hens per treatment. With 6 treatments, the test consisted of 288 hens.

The hens were housed and fed a normal lay ration for 2 days to accustom them to their surroundings. Feed was then removed for 1 week. Body weights were taken on the 7th day, just before placing them on the treatments listed in Table 1.

Table 1. Rations fed for 3 weeks following 7-day feed withdrawal, by treatment

Treatment No.	Ration 1/	
	Force molt feed	Grape/olive mix 2/3/
	percent	percent
1	100	0
2	80	20
3	60	40
4	40	60
5	20	80
6	0	100

1/ Percentages are based on weight.
2/ The 50% grape pomace/50% olive pulp meal mix was based on volume.
3/ Olive pulp meal included pits--was not lye processed.

Until this time, all the hens had been treated the same; therefore it was assumed that they had all reacted the same. Body weight data, collected at the time the feeding treatments started, were estimated to be 75 percent of their original body weight. Original body weights were calculated from this figure. Return to original body weight was determined by

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comparing subsequent body weights to this calculated figure.

Following the 7-day feed withdrawal period a commercial force molt ration (7 percent protein) diluted with the grape/olive meal mixture as per Table 1 was fed for 3 weeks. See Table 2 for the analysis of this mixture.

Table 2. Analysis of 50 percent grape pomace/50 percent olive pulp mixture[1/]

	Percent[2/]
Moisture	5.55
Crude protein	10.68
Fat	11.30
Crude fiber	25.03
Ash	16.29
Nitrogen-free extract	31.15
Calcium	0.70
Phosphorus	0.13

1/ Percentages are based on volume.
2/ Percentages are based on weight, as submitted.

For the next 3 weeks, all groups received a high-energy 20-percent protein ration designed to condition the birds for the next laying cycle. This was followed with a 16-percent protein lay feed for the remainder of the trial. Feed consumption for each ration fed, for each period it was fed, was recorded throughout the trial. Body weights were taken weekly for the first 13 weeks of feeding. Mortality data were collected daily but summarized weekly for the first 5 weeks following initiation of the trial; egg production was recorded daily with hen day rates calculated by 4-week periods for 6 periods following return to lay. Hen-housed production was also calculated for total production due to the higher mortality encountered in some of the treatments.

RESULTS

Body Weights - Body weight data are summarized in Figure 1. After 7 weeks on the 16-percent protein lay feed (13 weeks of feed), the controls (Treatment 1) returned to 100 percent of their estimated original body weight, whereas birds in Treatments 2, 4, and 5 were within 2 to 4 percent of the control weight at this point. Treatment 3 showed a higher recovery rate than expected. However, the differences in weights among Treatments 1 through 5 proved to be statistically nonsignificant, although earlier in the trial weight differences due to treatments were highly significant ($P < 0.001$).

Treatment 6 was terminated after 10 days on the 100-percent grape pomace/olive meal diet when the general appearance and physical condition of the birds indicated they would not survive another 2 weeks of this treatment. Note that they continued to lose weight (Figure 1) on the molt feed (100-percent grape/olive) at about the same rate as when feed was withheld.

Feed Consumption - During the first week on molt feed following the 7-day starvation period, the controls (Treatment 1) consumed 0.22 pounds of feed per hen day (Table 3). Birds on Treatments 2 and 3 (20 and 40 percent grape/olive mixture, respectively) consumed slightly more--0.24 to 0.25 pounds per hen day. This could be due to a lower metabolizable energy content of the diluted ration, even though the 50-50 grape/olive mixture analyzed 11.3 percent fat.

In treatments 3 through 6, consumption decreased as the content of grape/olive mixture in the feed increased from 40 percent to 60, 80, and 100 percent, respectively. At 100 percent, it is quite obvious that the hens simply did not like it. The hens in Treatment 6 consumed 0.11 pound of feed per hen per day and continued to lose body weight at about the same rate they had in the week of no feed.

Further evidence of the unpalatability of the grape/olive mixture is the increased consumption in the 2nd and 3rd week for Treatments 2 through 5. Physically, they could have eaten more the first week, but they did not.

Feed consumption by treatment for the 3 weeks on the 20 percent protein conditioner did not differ greatly except for the birds on Treatment 5 (80-percent grape/olive mixture). Their intake was higher, probably to compensate for the low energy content of the molt feed mixture. When all groups were returned to a regular 16-percent protein lay feed, there were essentially no differences in daily feed consumption.

Figure 1. Body Weight as a Percentage of Original Weight

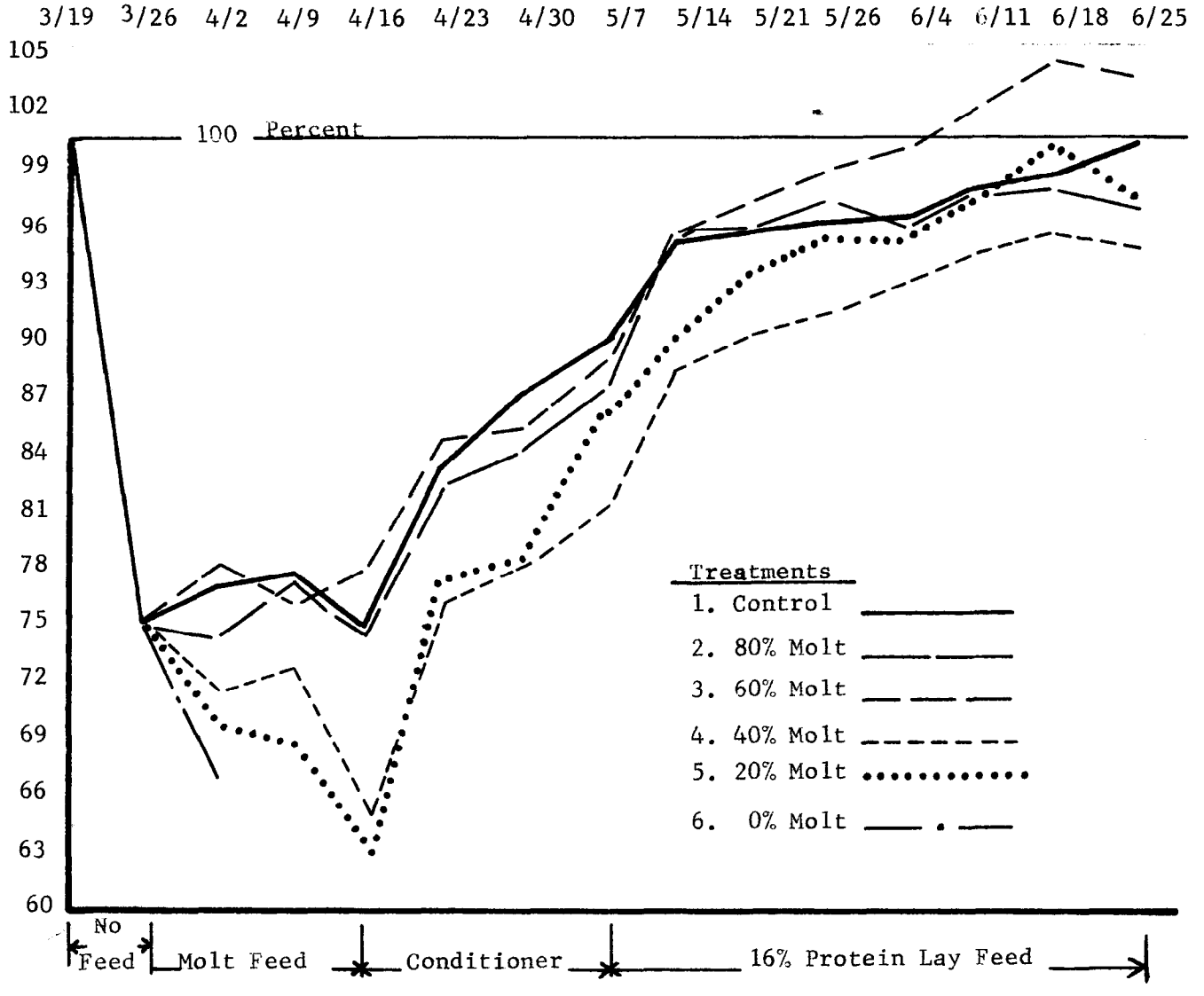


Table 3. Pounds of feed per hen per day

Ration:	Force molt feed			20% Protein conditioner			16% Protein lay feed						
Week ending:	4/2	4/9	4/16	4/23	4/30	5/7	5/14	5/21	5/28	6/4	6/11	6/18	6/25
Treatment:													
1	.22	.24	.28	.30	.25	.26	.26	.25	.24	.25	.25	.24	.24
2	.25	.28	.32	.31	.24	.25	.26	.26	.25	.23	.25	.24	.23
3	.24	.28	.34	.31	.26	.26	.27	.27	.26	.22	.27	.26	.25
4	.19	.23	.28	.33	.25	.25	.26	.25	.24	.25	.26	.25	.24
5	.15	.22	.27	.30	.29	.29	.27	.26	.24	.25	.24	.25	.25
6	.11												

Mortality figures for Week 1, the week of no feed, are a reflection of response to initiation of molt rather than treatment. At the end of the first week, all groups still were being treated the same.

Treatment 6 was switched in the middle of week 3-- after 10 days of 100 percent grape/olive mixture. Even so, 8 were lost in the 3rd week and two in the 4th week.

Table 4. Mortality for the first 5 weeks following initiation of molt[1/]

Treatment	Weeks 1	2	3	4	5	Total
1	0	0	1	1	0	2/ 2a
2	5	1	0	1	0	7a
3	2	7	1	9	0	19b
4	2	7	5	4	0	18b
5	2	5	6	7	2	22b
6	2	8	8	2	0	3/ 20na

1/ At start of trial there were 48 hens per treatment.
2/ Treatments with the same letter are not significantly different ($P < .001$).
3/ Not applicable.

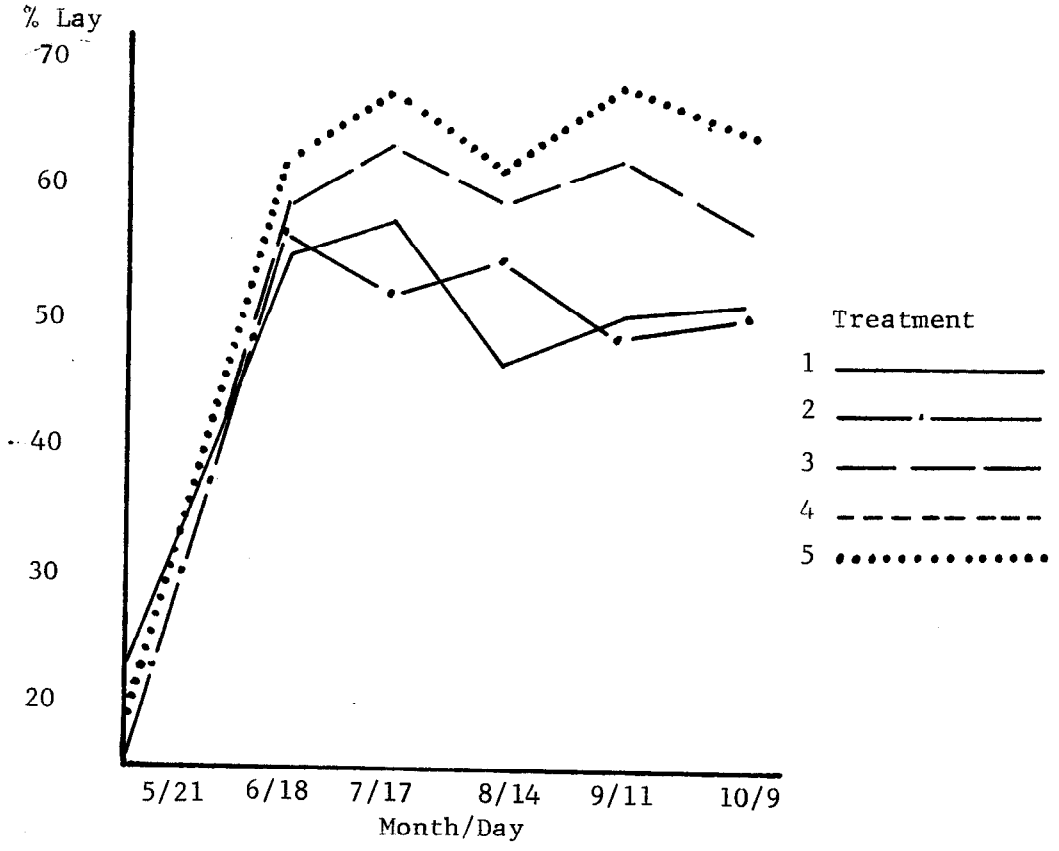
A statistical analysis of the mortality data for Treatments 1 through 5 gave a highly significant difference ($P < .001$) with the breaking point coming between Treatments 2 and 3. There were no significant differences between Treatments 1 and 2; nor were there any between Treatments 3, 4, and 5.

Although not considered in the experimental design, a factor unrelated to a limiting nutrient may have been involved in this trial. It is possible that a toxic substance was present in the grape-olive mixture. Laying hens that have gone 7 days without feed do not normally have the high mortality experienced in this trial in the treatments involving the higher levels of grape/olive mixture. The consumption data, discussed earlier, show a reduction in consumption as the percentage of grape/olive mixture increased. Actual consumption per hen of the grape/olive mixture portions of the rations in 3 weeks for Treatments 1 through 5 was 0, 1.2, 2.4, 2.9, and 3.6 pounds, respectively.

Treatments 1 and 2, eating 0 and 1.2 total pounds of the grape/olive mixture respectively, showed no significant difference in mortality. When the amount doubled to 2.4 pounds, the difference was significant ($P < .001$). A further increase of 0.5 to 1.2 pounds did not result in a further significant increase in mortality.

Egg Production - The final parameter summarized was egg production based on six 28-day periods of hen-day and hen-housed data. The hen-day data are given in Figure 2 and the hen-housed data in Figure 3.

Figure 2. Percent Hen-Day Egg Production by Four-week Periods



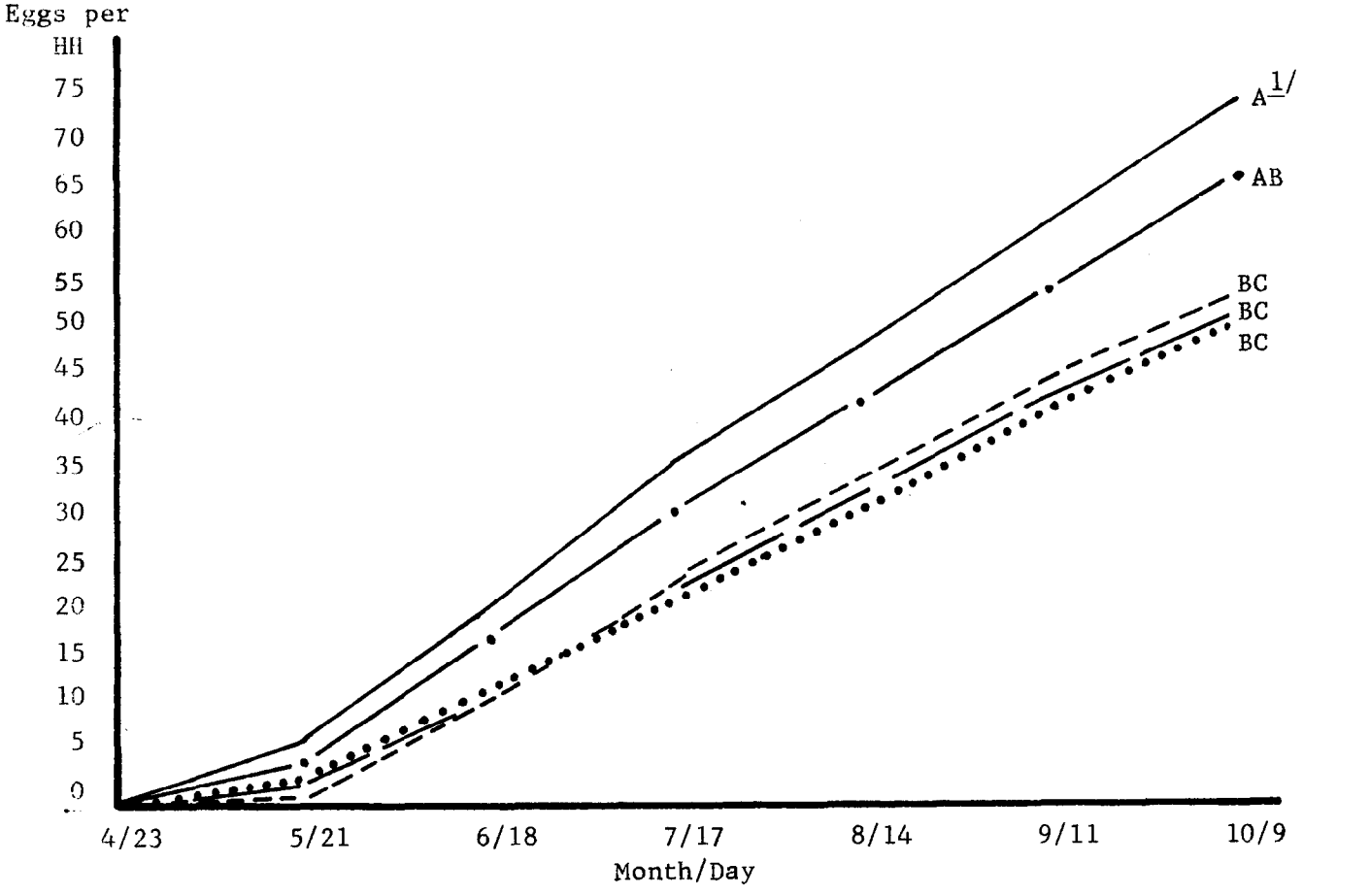
At first glance it appears that hen-day production was overwhelmingly in favor of Treatment 5, fed the highest level of grape/olive mixture for 3 weeks. Statistically, there was no significant difference in hen-day production due to treatment.

For hen-housed production (Figure 3) significant differences were found among the treatments. Treatment 1 was significantly higher ($P < .01$) than Treatments 3, 4, and 5. Treatment 2 was intermediate and not significantly lower than Treatment 1 but significantly higher ($P < .1$) than 3, 4, and 5. There were no differences among 3, 4, and 5.

ECONOMICS

An economical evaluation for the 5 treatments is given in Table 5. Line 1 is the total cost for the 3 weeks of molt feed fed to the hens originally started (48 hen-house capacity) for each treatment. Price per pound of feed was calculated using 4.2¢ per pound for molt feed and 2.6¢ per pound for the 50-50 grape/olive mixture. Percentages of the blends for the different treatments using these values were applied without adding a mixing fee to determine price for the 5 treatments. For Treatments 1 through 5, these prices per pound were 4.20¢, 3.88¢, 3.56¢, 3.24¢, and 2.92¢, respectively.

Figure 3. Hen-housed Egg Production Plotted Every 4 Weeks



1/ Treatments with different letters are significantly different ($P < .01$).

Treatment
1. ————————
2. ———— • ————•
3. ———— ————

Treatment
4. — — — — — — —
5. • • • • • • • • • • • •

The total pounds of 20 percent protein conditioner fed for each treatment was assigned 6.4¢ per pound to determine the costs for Line 2, Table 5. In Line 3, the 16 percent protein feed cost was 6.17¢ per pound, and this amount was applied to the pounds of feed each treatment consumed for the remainder of the trial. Line 4 gives the total feed cost for each treatment.

Lines 5, 6, 7, and 8 are self-explanatory. Line 9 indicates egg income minus feed cost plus fowl value for each treatment. Calculated on a per hen housed basis, these income values for Treatments 1, 2, 3, 4, and 5 are 42¢, 25¢, 32¢, 33¢, and 52¢, respectively. Treatment 5 had a possible 10¢ per hen housed advantage over Treatment 1 in this trial.

CONCLUSION

The production graph indicates that the average hen-day production for Treatment 5 was higher in this trial than the other treatments, but the variation between replications was so great that the difference noted was not significant. In other words, it could have happened by chance rather than have been due to treatment.

Because there was no significant difference in production, coupled with a highly significant ($P < .001$) increase in mortality for the higher levels of grape/olive mixture (Treatments 3, 4, and 5), the use of grape/olive mixture at high levels in a molt ration is not recommended. Even at a low level, the hens in Treatment 2 seemed to overcompensate by eating more feed at the beginning, resulting in little savings in feed cost per hen housed.

The possible toxicity problem mentioned earlier is another reason to be wary of the use of 50 percent grape pomace and 50 percent whole olive meal. The mortality encountered in Treatments 1 and 2 was not significantly different. The difference between Treatments 2 and 3 was highly significant ($P < .001$). Between Treatments 3, 4, and 5 there were no significant differences. Treatment 6 was dropped due to the poor condition of the hens and the doubt that they would survive.

Table 5. The economics of feeding a mixture of grape/olive as 0, 20, 40, 60 or 80 percent of a force molt feed

Line	Treatments 1	2	3	4	5	Factor: Based on 48 HH capacity
1	10.31	9.56	8.01	5.99	4.70	Molt feed cost ($)
2	16.55	14.76	11.04	12.06	10.46	20% protein conditioner cost ($)
3	99.66	90.77	64.77	69.63	58.39	16% protein lay mash cost ($)
4	126.52	115.10	83.82	87.68	73.55	Total feed cost ($)
5	299.5	264.6	208.3	217.2	207.2	Total dozen eggs laid
6	134.78	119.07	93.74	97.74	93.24	Egg income at 45¢/dozen ($)
7	44	40	28	30	26	Number of hens at end of trial
8	8.80	8.00	5.60	6.00	5.20	Fowl value @ 4 lbs/hen and 5¢/lb ($)
9	20.06	11.97	15.52	16.06	24.89	Egg income minus feed cost plus fowl value

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