

Station Circular of
Information No. 429

June 1948

Turkey Investigations
Umatilla Branch Exp. Sta.

FIFTEEN YEARS OF TURKEY INVESTIGATIONS
AT THE UMATILLA BRANCH EXPERIMENT STATION
Hermiston, Oregon

by

D. H. Sherwood and Carl A. Larson

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The Umatilla Branch Experiment Station is located in the western end of Umatilla county and on the southern edge of the Umatilla Reclamation project about two miles south of the city of Hermiston. The station is about 10 miles from the Columbia River and about 600 feet above sea level. The farms of this area are small and turkey raising is one of the principal sources of income.

DISEASES APPEAR. Turkeys were produced on the Umatilla Reclamation project on only a small scale prior to the start of turkey investigations at the Umatilla Branch Experiment Station. Turkey raising appeared to be a profitable type of enterprise, but various problems of management and disease began to appear early. It was to find a solution to these problems of management and feeding and also to demonstrate that disease could be prevented by growing turkeys on limited range, that work at this station was begun.

Turkey production had shifted from the eastern states to the West largely because of disease problems arising from contaminated ground where chickens and turkeys had been grown for many years. 3/

1/ The authors wish to acknowledge the work of the late H. K. Dean, formerly superintendent, who conducted the investigation to 1938 and from 1943 until his retirement.

The investigations were conducted cooperatively with the Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Irrigation Agriculture.

The authors also wish to acknowledge the cooperation given by the late H. E. Cosby, formerly head of the poultry department at Oregon State College, and C. E. Holmes and J. A. Harper, also members of the poultry department staff, and by N. L. Bennion, extension poultryman.

2/ Research assistant and superintendent, respectively, Umatilla Branch Experiment Station, Hermiston, Oregon.

3/ Turkey Management, by Marsden and Martin.

CHICKEN MASHES NOT SUITABLE. It had also been a common opinion among turkey growers that any good chicken feed would likewise be a good feed for turkeys. However, it was found early 4/ that ordinary chicken mashes were not sufficiently high in animal protein to meet the growth requirements of turkeys. Therefore, it became necessary to investigate other rations.

To meet this situation, work on growing and finishing rations and pasture crops were main projects for many years. Later, work on the effect of artificial lights on breeding stock was added. Other breeding work involved a comparison of Standard Bronze with Broad-breasted Bronze turkeys. Some comparisons were also made with small type United States Department of Agriculture Whites.

SUBSTITUTE FEEDS TRIED. During the war, various substitute feeds for both growing and breeding stock were tested. Especially studied were hatchability and fertility of eggs produced with war-time emergency feeds.

EFFECT OF GREEN FEEDS DETERMINED. Early in 1931 and 1932 the flock was divided into four groups for study of the effect of green feed, both as dry pasture and as dried alfalfa leaves. It was found that the lowest feed cost per pound of gain resulted from pasture feeding of alfalfa, and the highest cost from the ration with no green feed. (Table 1)

Finishing Turkeys

In 1933 and 1934 the experiments were conducted on various methods of finishing turkeys with the experimental period being limited to the finishing period: approximately 8 weeks from October 2 until the birds were marketed.

MASHES AND SCRATCH GRAINS TESTED. Both high and low protein mashes in conjunction with scratch grains were tested. Also tested were scratch grains fed without mash but with and without skim milk.

In 1933 a wet mash was also used in conjunction with a scratch ration of wheat, corn, and oats. The high-protein mash contained approximately 19.1% crude protein, and the low protein mash approximately 13.3% crude protein.

All birds had access to grit, oyster shell, dry alfalfa hay, and water at all times. During the growing season all birds were fed the same, receiving a mash of approximately 17% protein, whole grain scratch, liquid skim milk, and alfalfa pasture.

SEXES COMPARED. In 1933 several of the lots had both hens and toms, while in 1934 the sexes were separated in all lots for the purpose of studying the relative protein requirements of the sexes.

TOMS MADE MOST RESPONSE TO HIGH PROTEIN. The results show that the average weights of the hen turkeys in all lots were about the same, but that there were differences in the average weights of toms. The toms which received no green feed were noticeably lighter than toms in the other three groups.

MORE GRAIN REQUIRED WITHOUT GREEN FEED. The feed consumption data show that turkeys that were fed no green feed required 1.2 more pounds of feed to produce a pound of gain than those fed chopped green alfalfa; and 1.3 more pounds than those on alfalfa pasture. The turkeys on the alfalfa pasture required only 81% as much feed to produce a pound of gain as those that received no green feed.

GREEN FEED REDUCES COST. The costs of production were 2.3 and 2.5 cents per pound less in the lots receiving the chopped green alfalfa and alfalfa pasture respectively than in the lot that was not fed green feed. It was apparent that providing alfalfa, either as pasture or as chopped green feed, substantially reduces feed costs in the production of market turkeys.

The addition of 10% dry alfalfa leaves to the mash did not greatly affect either the efficiency of feed utilization or the cost of production. Toms on low-protein mash gained 52.2% of their pre-finishing period weight; toms on scratch plus milk gained 43.2%; toms receiving scratch alone gained only 32%. The average weights at the end of the finishing period were in the same order as the percentage of gain.

SCRATCH PLUS MILK BEST FOR HENS. With the hens, the best results were obtained from scratch plus milk and the poorest from scratch alone, although the difference in the three best lots was so small as to be insignificant. (Table 2) Part of this table has been previously published. ^{5/} No explanation is offered why the hens of Lot 4 in 1946 required no more feed per pound of gain than the toms.

LESS FEED REQUIRED WHEN SCRATCH FED. In general the birds on the scratch rations required less feed per pound of gain than those receiving mash. However, the mash that was used contained a lower percent of digestible nutrients than did the scratch grains. The mash-fed birds were also heavier and more desirable for market.

Protein Level Feeding Trials

In 1935 and 1936, experiments were conducted involving three levels of protein mashes fed with scratch. In addition, one group of birds received no mash but was fed liquid skim milk in addition to scratch.

CLINE METHOD USED. One lot of turkeys were hand-fed scratch in a fixed proportion to the amount of mash consumed. The percentage varied, according to the Cline method, ^{6/} from 5% of the mash consumption for the second week to 50% for the 24th week, after which they had free access to both mash and scratch at all times. All other lots had all of their feed before them at all times.

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^{5/} Oregon Circular of Information, No. 124, September 1935.

^{6/} Turkeys, University Nevada Bulletin 86, 1939, p. 90.

CONDITIONS THE SAME FOR MOST FACTORS. In all four lots the birds had access to oyster shell and grit at all times. During the growing season all were pastured on green alfalfa. During the brooder house period all birds had been fed and handled the same, with the various lots being made up by random selection from the birds in the brooder house.

HEAVIEST TOMS FROM HIGH PROTEIN LOTS. For both years the heaviest toms were produced in the high-protein lot. The lightest toms came from the scratch-and-milk pen in 1935, and from the low-protein-mash pen in 1936. The hens were apparently somewhat less affected by the difference in protein level, even though the lightest birds came from the low-protein pens in both years. The heaviest hens in 1935 came from the medium-mash pen and in 1936 from the scratch-and-milk pen.

SCRATCH AND MILK GIVE LOWEST COST. In all cases the lowest feed cost per pound of gain and the greatest margin over feed cost came from the birds on the scratch-and-milk diet.

HENS NEED MORE FEED PER POUND. In 1936 when the sexes were kept in separate pens, the hens required slightly more feed per pound of gain than the toms except in the low-protein pen where the sexes ate about the same amount. The toms required the least feed per pound of gain in the high-protein pen and the most in the low-protein pen. The hens required the least feed per pound of gain in the scratch-and-milk pen and most in the medium (standard) mash pen. Hens, because of their slower rate of growth, are more tolerant of low-protein rations than are toms.

These findings agree with those of previous years on studies of finishing rations.

MASH AND PELLETS COMPARED. The station commenced some feeding trials comparing mash and pellets for growing turkeys in 1940. For the first year the feeding trial consisted of only two pens, each of about 100 birds. One pen had the standard OSC grower mash, plus scratch consisting of whole wheat, corn, barley, and oats. The other pen had the identical ration except that the mash was pelleted. All birds had free access to oyster shell and grit and were pastured on alfalfa.

In 1941 and 1942 five lots of Broad-breasted Bronze were maintained as follows: Pen 1, mash and scratch; pen 2, pellets and scratch; pen 3, 30% protein concentrate mash and scratch; pen 4, mash and scratch and during the last three months of the growing period a supplemental mid-day feeding of all the pellets the birds would clean up in 30 minutes; pen 5, mash and scratch, with a supplemental feed during the last three months consisting of milk-soaked rolled barley mixed with alfalfa meal.

LITTLE DIFFERENCE IN COST OF GAIN. In 1941 there was no significant difference in the feed cost per pound of gain of any of the pens. (Table 3) In 1942 the birds receiving the supplement of milk-soaked barley grew somewhat more economically than the others and the concentrate-fed birds were least economical. (Table 3) No explanation is offered as to the cause of this difference.

In both years the concentrate-fed birds consumed considerably less mash in proportion to scratch than the other pens, thus making greater use of the whole grains which could be home grown.

The 1941 results have been previously published. 7/ The results of these trials indicate that the exact method of feeding is not important, if the birds have free access to a good, well-balanced feed; also that there is little, if any, value in supplemental feeds when the basic ration is adequate.

Emergency Feeds

During the war years the shortage and unavailability of various high-protein concentrates, such as meat meal, fish meal, dried skim milk and dried whey, made it advisable to conduct trials with various emergency feeds.

Several such rations designed for starting and growing were tested through 1945. (Emergency breeder rations were also tested, but these will be discussed separately.) In all three years a sufficient amount of the hard-to-get feeds were obtained to mix a limited amount of mash according to the prewar formula. This was fed to one lot of turkeys for comparison.

SCARCE FEEDS REPLACED FOR TRIALS. In the various emergency rations, varying amounts of fish and meat meal were replaced by soybean oil meal as a source of protein. The riboflavin lost when part or all of the milk by-products were left out was obtained from distiller's dried solubles or from a synthetic vitamin mix. In one series of rations, the phosphorous lost from the omission of bone meal was made up by adding raw rock phosphate.

In the 1944 and 1945 trials, a high-protein concentrate mash was tested in conjunction with the emergency mashes of average protein content and the prewar mash. (Table 6) The starting ration of all groups contained the same ingredients as the corresponding grower ration, but with the formula adjusted to give a slightly higher protein content. (Table 7)

PREWAR MASHES GAVE MOST ECONOMICAL GAINS. The prewar standard mash gave the most economical gains in 1943 and 1944 from the standpoint of amount of feed consumed and the cash cost per pound of gain. In 1945 the prewar mash did not give quite so economical gains as the other mashes, but the difference in favor of the emergency mashes was considerably less than the previous difference in favor of the prewar mash. (Table 7)

RATION OF MASH TO SCRATCH ABOUT SAME. The ration of mash to scratch consumption is approximately the same for all groups except the high-protein mash group which consumed considerably more scratch than the other birds. It happened that the birds were slightly older at marketing in 1944 than in 1943 and still older in 1945.

OLDER BIRDS ATE MORE SCRATCH. The ratio of mash to scratch went down as the age went up. The lot 3 birds in 1944 received a ration with greater use of substitutes than the birds in the other lots. While their economy-of-production record was second to that of birds on prewar rations, they had a slightly lower percentage of prime birds than any other lot. There was less uniformity in this lot than in any of the other lots.

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Emergency Rations For Breeder Hens

From 1943 through 1946, various emergency breeder rations were used in comparison with the prewar standard Oregon State College mash. In the last three years a 30% protein concentrate mash was fed to a fourth pen. Formulas of all mashes, including the prewar, are given in Table 8. All mashes gave fairly satisfactory results, although the prewar mash in general was superior to the others. (Table 9)

LAYING COMPARISONS. Taking an average of the three years, the birds receiving the prewar mash ranked second in egg production with the first emergency ration being the high pen. The concentrate-fed birds had the best fertility, although they laid the fewest eggs. These were followed by the birds on the standard ration, which pen also showed the best hatchability of fertile eggs. The birds on the emergency ration gave the poorest fertility and hatchability of the four pens. It was considered, however, that the second emergency ration was farther removed from what is normally considered a standard ration than the first. Egg production, fertility, and hatchability by pens are shown in Table 9.

SOME PENS ON PASTURE. The 1945 pen referred to as 2-A received the same basic ration as No. 2 pen, but had access to grass pasture starting March 26, prior to which date they had been in the No. 2 pen. It is probable that the hens placed on pasture, although they were taken by random selections, were better layers than those left in Pen 2. This conclusion is based on fact that the production in the balance of March, before the pasture could have been expected to have much effect, was superior to that of birds left in Pen 2.

However, as individual records are not available, comparable production, prior to division, is assumed in this table.

ADDED VITAMINS DID NOT INCREASE HATCHABILITY. The 1946 pen referred to as 2-A had the same basic ration as Pen 2, except that the amount of A and D vitamin oil was doubled. As the fertility and hatchability was considerably poorer than in the parent pen, it is evident that the added vitamins had no beneficial effect in this instance.

Comparison Of Breeds

For breeding experiments at this station, a late-maturing strain of Bronze turkeys was raised for several years, as well as the Standard, or early maturing Bronze. The Standard Bronze were also crossed with Broad-breasted Bronze. Starting in 1941 only the Broad-breasted were raised. Comparative feed consumption and growth records on these strains, as well as two years' results with small type U.S.D.A. Whites, are presented in Table 10. All birds were fed a mash of approximately 20% protein and a scratch mixture of four grains. They got alfalfa pasture in season.

100 BIRDS PER TEST PEN. A comparable number of birds, usually 100 or more, were in all pens except that in 1942 there were only 50 birds in the Standard Bronze pen.

LATE MATURING BRONZE REQUIRED MORE FEED. The birds of the late maturing Bronze strain were smaller than the other birds when marketed, although approximately six weeks older. As a result of the considerably longer growing period, they consumed considerably more feed per pound of gain than the others. The Standard Bronze were approximately the same size, and the feed cost per pound of gain was approximately the same as the Broad-breasts. The Standard Bronze birds in 1942 were an exception, as they required 10% more feed per pound of gain than the Broad-breasts.

WHITES TOOK SLIGHTLY MORE FEED PER POUND. The small type whites were marketed when about a week younger than the Broad-breasted Bronze and weighed only about 65% as much. In spite of the small size of the Whites, they consumed only a little more feed per pound of gain than did the Bronze. The Whites consumed a lower percentage of mash in 1942, but in 1943 their relative consumption was approximately the same as that of the Bronze.

Use Of Lights On Breeder Hens

From 1939 through 1942, experiments were conducted on the use of artificial lights on breeder hens to stimulate early egg production. During the first three years of the work the lighted hens were housed, but during the last year they had no shelter. In all four years the birds without lights had no shelter. Each year there were two 12-hen pens with lights and two 12-hen pens without lights.

LIGHTED BIRDS HAD A 14-HOUR DAY. Lights were turned on in the mornings with the time being adjusted to make a 14-hour day. An ordinary alarm clock was used to turn the lights on. The date of turning the lights on varied a little from year to year, but during the first three years averaged about the first of January.

LAYING INCREASED. Fifty percent production was reached in 32 days for the 3-year average. In 1942 the lights were turned on January 13, and 50% production was reached in 35 days. The unlighted birds were also a few days slower in reaching 50% production in 1942 than in previous years, the date being March 13, as compared to an average of March 8 for the first years. (Table 11)

LIGHTS LENGTHEN SEASON. Breeder birds were sold about the first of May and thus the lighted birds had an egg laying season of nearly three months. The unlighted birds were laying for a period of from 6 to 8 weeks on the average.

The increase in egg production from lights and shelter was approximately 53%--(36 settable eggs per hen to 55 eggs). In 1942 (the one year with lights and no shelter) the increase was approximately 36% (from 33 to 45 eggs per hen). The season was nearly two weeks shorter for the lighted birds in 1942 than it had been in the previous years.

Only in 1942 was there a sound comparison possible between hens under lights and not under lights. In all previous years an additional variable was involved: that of shelter versus no shelter. It appears, however, that the 36% increase in egg production of lighted birds in 1942 can be largely attributed to the use of lights. Probably a major part of the 53% of previous years was also due to lighting, but adequate comparisons are not possible because corresponding pens unlighted but sheltered like the lighted pens were not studied.

HATCHABILITY NOT AFFECTED. Fertility and hatchability of egg, and livability of poults did not seem to be affected by the use of lights. There was considerably more variation between different birds in the same pen than between the various pens. (Table 11) A few birds produced eggs of almost 100% fertility while others had almost no fertility. There were also a few hens that layed only two or three eggs in an entire season.

Feed consumption of lighted and unlighted pens for the year 1942 is shown in Table 5. While total feed consumption of the lighted pens is only slightly greater than that of the unlighted pens, the mash consumption is considerably greater.

HEAVY LAYERS ATE MORE MASH. With the lighted pens the mash ate was approximately 35% of the total feed consumption while with the unlighted pens the mash amounted to only 25% of the feed consumption. This difference is probably due to the greater protein requirements of egg production. The amount of feed required to produce 100 EGGS WAS CONSIDERABLY LESS IN THE LIGHTED THAN THE UNLIGHTED PENS.

Breeds Compared

During the time that experiments with artificial lights were being carried on, a comparison of Standard-bred Bronze and Broad-breasted Bronze was also being made, with the same birds being used for both purposes. In 1940, Standard-bred hens were mated to Broad-breasted toms and their progeny were mated back to Broad-breasted toms the following year. In addition some Broad-breasted hens were purchased and mated to the same toms.

In 1941 the Standard Bronze hens produced more eggs than the Broad-breasted, and the cross-bred birds were intermediate. Both the Standard Bronze and cross-bred birds excelled the Broad-breasted in fertility and hatchability. In 1942 the Standard Bronze failed to do as well as in the previous year, due possibly to in-breeding.

In 1938 and again in 1940, a few of the best hens were kept over for a second breeding season. Results were unsatisfactory, as none of the hens laid nearly so well the second year.

FEW EGGS LAID AFTER JUNE 30. All of these hens were still laying when trapnesting was discontinued on June 30, but laid comparatively few eggs thereafter. It may be seen that not only was the rate of laying poorer in the second year, but the date of beginning to lay was later, except for the two hens that had the benefit of lights in the second year. The length of season as shown in Table 5 is calculated from the date of the first egg to April 30. Fertility and hatchability on eggs from second year layers was approximately as good as that of their eggs in the first year.

OLD TOMS NOT GOOD BREEDERS. All three of the 1940 hens kept for a second year were sired by sons of hen No. 410 that made the best 1938 record. Only in one year were toms kept for a second breeding season, and none of them proved to be satisfactory breeders in the second year.

Discussion Of Principal Findings

Pasture

The effect of succulent green feed in the ration was clearly demonstrated in the 1931 experiment.

MORE FEED REQUIRED ON DRY LOT. Birds in a dry lot required 28% more feed than birds that had chopped green feed. The value of the alfalfa the birds harvested was estimated as being approximately four-tenths of a cent per pound per turkey, based on the field yield of about one ton per acre per cutting, and the price of alfalfa at that time of about \$6 per ton. This left a margin of 22% in favor of pasturing alfalfa over dry lot feeding.

\$6 ALFALFA BECOMES \$77 ALFALFA. Calculating the value of the alfalfa from the amount of feed that it saved gave a per-ton value of \$77, even at the low feed cost prevailing at \$1.91 per hundredweight for mash and \$1.44 for scratch. The amount of feed saved per 1000 turkeys would be \$440. At present (1948) feed prices the saving would be much greater.

LET BIRDS HARVEST OWN ALFALFA. Although the birds fed chopped green alfalfa twice daily made practically as economical gains as those on alfalfa pasture, there is considerable labor saving in allowing the birds to harvest their own greens. The 70 birds in this trial pastured four 1/10-acre plots, taking one cutting from each plot. Little damage was done to alfalfa stand when used as turkey pasture when the birds were moved from one field to another at least two or three times per season--and if feeding and watering equipment and roosts are occasionally moved.

Finishing methods

In the finishing trials of 1933 and 1934, satisfactory results were obtained, from the standpoint of cost of gains, from feeding scratch grains alone or scratch grains supplemented with liquid skim milk.

BETTER FINISH WITH MASH. The mash-fed birds were heavier and better finished. Inasmuch as under present day marketing conditions the quality of the dressed carcass is of more importance than at the times these tests were conducted, it is even more important to feed a complete ration, including both mash and scratch.

TOMS RESPOND MOST TO PROTEIN. The toms responded somewhat better than the hens to high protein feed, due to their greater rate of growth. It is doubtful whether liquid skim milk is a practical feed either for finishing or growing purposes for anyone except possibly the small producer, even though it did give satisfactory cost results in the trials referred to here. There is considerable labor involved in feeding it and in keeping containers clean. It also draws flies in considerable numbers.

Feeding methods

The trials of 1940-42 show that it costs approximately the same per pound of gain to feed pellets as to feed mash, when pellets cost approximately \$2 a ton more than mash. There was somewhat less wastage from feeding pellets than scratch--

there is less tendency for the birds to "bill" it out of the hopper. Furthermore, pellets are not blown out of the hoppers as mash may be on a windy day. These conditions also make for slightly less labor in handling pellets than mash.

LESS FEATHER PICKING WITH PELLETS. There is also less feather picking when pellets are fed instead of mash. Mash-fed birds tend to pull at a neighbor's tail feathers in an attempt to remove mash adhering to their beaks. This is especially true if the mash ingredients are very finely ground. The tail feathers of pellet-fed birds in this experiment were much neater than those in mash-fed pens.

It was found that the beak-wiping of mash-fed birds could be somewhat reduced by stretching a wire the length of the hopper, just above the mash.

LESS HIGH-PROTEIN MASH CONSUMED. Birds receiving a 30% protein mash consumed considerably less mash and thus more scratch than birds getting a 20% mash in either mash or pellet form. The percentage of mash intake, for the above-mentioned lots in 1941 was 48.77%, 64.85%, and 64.62% respectively. There was no significant difference in the feed cost per pound of gain in these lots. All feeds in this experiment were purchased. If home-grown scratch grains were available, it might result in a substantial cash saving to feed the 30% mash.

REGARDING SUPPLEMENTAL FEEDING. Supplemental feeding of pellets, or of rolled barley soaked in skim milk, and mixed with alfalfa meal did not give any saving in feed cost when fed to birds receiving a basic ration of mash and scratch. The supplemental feed was hand fed twice daily. Inasmuch as considerable hand labor is involved, especially in handling a feed that involves soaking, it would not be commercially feasible to supplement a ration that was already adequate.

Breed differences

The Standard Bronze were of about the same size as the Broad-breasted and gave approximately as economical gains. They had a less desirable dressed appearance.

The small type white birds gave nearly as economical gains as the Bronze, but they required nearly as long to finish out.

NO ADVANTAGE FOR SMALL WHITES. As costs other than for feed, such as hatching, brooding, and labor of raising are nearly as great for small turkeys as for large, it probably would not be practical to raise them in preference to the Broad-breasted Bronze unless they could be sold for a higher price per pound.

Most of the white turkeys raised at this station were sold on the local market. While they were well received by the family trade, they did not command any higher price than the larger Bronze, because of the influence of army buying and the controlled market. The dressed carcass of the Whites was pleasing in appearance, and was comparatively free from pin feathers. For a grower having a specialty market with the family trade, the Small White might be the desirable bird to grow. No other small type turkey has been raised at this station.

Artificial lights for egg production

The experiments with artificial lights on turkey breeding stock from 1939 through 1942 clearly demonstrated that early egg production could be obtained with artificial lights. By turning on lights the first of January, over 50% more eggs could be obtained in a season lasting to April 30, without materially affecting fertility or hatchability. There was an increased feed consumption of about 5% per bird, however. Approximately 46% more eggs were produced for each 100 pounds of feed consumed when pens were lighted.

LIGHTS GREAT HELP TO BREEDERS. As 50% egg production can be obtained approximately one month after lights are turned on, this is of considerable importance to breeders who want early eggs for their own use, or for sale to others. For those who do not desire eggs before March there would be no advantage to using lights. Normal egg production starts early in March in this area.

Once production has started there would be no increase from use of lights. Breeder birds that have been lighted weigh approximately as much at end of breeding season as unlighted birds, so their market value is about the same.

Conclusions

1. Use of growing pasture substantially reduces feed cost of growing turkeys. Dry alfalfa leaves in the ration make it more efficient than a ration containing no green matter if turkeys are not on pasture.
2. Heavier birds at market age will be obtained if a 20% protein mash is fed during the finishing period instead of a mash of lower protein content or feeding an all-scratch ration.
3. When pellets cost up to \$2 per ton more than mash, they may be fed without appreciably affecting the feed cost per pound of gain.
4. More scratch grains are consumed when a mash of 30% protein is fed in place of a mash of 20% protein. This gives no added economy if the scratch grains must be bought.
5. If the basic ration is adequate there are no benefits from feeding supplemental feeds such as barley and alfalfa meal soaked in milk.
6. War-time emergency rations in which soybean oil meal replaced part of the fish meal and distillers dried solubles replaced the dried whey proved adequate in both grower and breeder turkey rations.
7. Use of artificial lights on breeding stock starting January 1 resulted in an increased egg production of approximately 53%. Fifty percent production was reached approximately one month after lights were turned on. Fertility and hatchability were not greatly affected by the use of lights.
8. It is not economical to keep turkeys for a second breeding season, as hens lay fewer eggs and start laying later in the season. Two-year-old toms are not so successful at breeding as in their first year.

Table 1. DRY LOT vs DRY ALFALFA AND ALFALFA PASTURE

UMATILLA FIELD STATION

1931 data

Lot No.	Type of Greens	Average Dressed Weight at 32-36 Weeks Age			Feed Consumed per Pound Gain			Mash and Grain Cost Per Pound Gain - (cents)
		Hens	Toms	Both	Mash	Scratch	Total	
1	No Greens.....	13.0 lbs.	20.4 lbs.	16.7 lbs.	3.65 lbs.	2.99 lbs.	6.64 lbs.	11.27
2	10% Alfalfa leaves.....	13.3 lbs.	22.9 lbs.	18.1 lbs.	3.07 lbs.	3.43 lbs.	6.50 lbs.	10.80
3	Chopped green alfalfa.....	12.9 lbs.	23.1 lbs.	18.0 lbs.	2.45 lbs.	3.00 lbs.	5.45 lbs.	9.00
4	Alfalfa pasture..	12.8 lbs.	24.3 lbs.	18.6 lbs.	2.44 lbs.	2.93 lbs.	5.37 lbs.	8.80

Mash cost per cwt \$1.91

Scratch cost per cwt \$1.44

Cost of alfalfa not included in costs.

Lot 2 received 200# leaves per ton of mash.

Lot 3 all chopped green alfalfa fed twice daily.

Lot 4 pastured 4 plots of 1/10 acre each. One crop only.

Table 2 WEIGHTS AND FEED CONSUMPTION WITH DIFFERENT LEVELS OF PROTEIN FEEDING

1935 data									
	Lot 1		Lot 2		Lot 3		Lot 4		
	24.4% Mash	Limited Scratch	20.9% Mash, Un-	Limited Scratch	No mash, Unlimited	Scratch -- Milk	18.4% Mash	Unlimited Scratch	
Feed per pound of gain. pounds	5.06		5.04		4.83*		5.18		
Feed cost per pound of gain cents	10.2		10.1		9.25		10.1		
Total pounds of grain consumption . . . pounds	8579		9436		7235		6114		
Percent mash percent	70.6		57.8		—		64.7		
Average live weight Toms Nov. kill. . . pounds	23.2		21.9		20.5		21.1		
Average live weight Toms Dec. kill. . . pounds	25.8		24.1		23.4		23.1		
Average live weight Hens Nov. kill. . . pounds	13.6		13.6		13.5		12.9		
Average live weight Hens Dec. kill. . . pounds	13.9		14.4		13.9		13.9		
Percent killed November. percent	52.2		53.1		53.1		59.7		
Percent U. S. Prime percent	91.3		94.9		94.9		94.0		
1936 Data									
	Toms		Hens		Toms		Hens		
Feed per pound of gain. pounds	4.34	4.89	5.06	5.19	4.54	4.61	5.10	5.08	
Feed cost per pound of gain cents	10.5	11.9	11.2	11.8	9.5	10.1	11.3	11.3	
Total pounds of grain consumption . . . pounds	5570	3890	5812	4100	4611	3572	5351	4170	
Percent mash percent	73.4	74.7	50.3	49.8	—	—	51.1	54.7	
Average live weight Nov. kill pounds	26.5	16.2	25.1	15.7	26.2	16.8	23.7	15.3	
Average live weight Dec. kill pounds	28.4	16.4	28.1	16.1	28.3	16.1	27.1	15.8	
Percent killed November percent	43.5	67.4	48.8	57.2	48.8	53.6	37.5	64.2	
Percent U. S. Prime percent	95.6	100	83.8	100	90.7	100	97.5	100	

1936 Feed Costs		1935 Feed Costs	
Alfalfa.	\$10.00 per ton.	Alfalfa.	\$10.00 per ton
Skim milk.25 per cwt. (liquid)	Skim milk.25 per cwt. (liquid)
Scratch	1.91 per cwt.	Scratch	1.59 per cwt.
Lot 1 Mash	2.40 per cwt.	Lot 1 Mash	1.91 per cwt.
Lot 2 Mash	2.34 per cwt.	Lot 2 Mash	1.96 per cwt.
Lot 4 Mash	2.23 per cwt.	Lot 4 Mash	1.78 per cwt.
Starter Mash	Low \$2.42 per cwt. High \$2.50 per cwt.	Starter Mash	2.29 per cwt.

* Includes solid matter of skim milk.

Table 3. WEIGHT AND FEED CONSUMPTION, MASH vs. PELLETS vs. SUPPLEMENTAL FEEDS

1941 data

	Mash and Scratch	Pellets and Scratch	Concentrate and Scratch	Mash Scratch Pellets	Mash Scratch Soaked Barley Alfalfa
Age in days at marketing....	207	207	207	207	207
Feed per pound of gain.....	4.46 lbs	4.25 lbs	4.40 lbs	4.44 lbs	4.66 lbs
Feed cost per pound gain....	11.0¢	10.9¢	10.5¢	11.2¢	11.1¢
Total feed per bird.....	93.89 lbs	94.65 lbs	95 lbs	97.21 lbs	102.15 lbs
Percent mash.....	64.83%	64.62%	48.77%	68.42%	60.44%
Percent scratch.....	35.17%	35.38%	51.23%	31.58%	39.56%
Oyster shell per bird.....	1.29 lbs	1.41 lbs	1.49 lbs	1.15 lbs	1.22 lbs
Grit per bird.....	2.86 lbs	2.38 lbs	2.79 lbs	2.84 lbs	2.38 lbs
Average live weight of toms.	26.4 lbs	26.2 lbs	26.2 lbs	26.6 lbs	27.3 lbs
Average live weight of hens.	16.4 lbs	16.0 lbs	16.1 lbs	16.6 lbs	16.3 lbs
Percent U.S. Prime.....	96.5%	100%	96.7%	97.7%	100%

1942 data

	Mash and Scratch	Pellets and Scratch	Concentrate and Scratch	Mash Scratch Pellets*	Mash Scratch Soaked** Barley** Alfalfa
Age in days at marketing....	225	225	225	225	225
Feed per pound of gain.....	5.21 lbs	5.05 lbs	5.48 lbs	5.19 lbs	4.84 lbs
Feed cost per pound gain....	16.5¢	16.5¢	17.2¢	16.4¢	15.2¢
Total feed per bird.....	108.45 lbs	106.9 lbs	121.75 lbs	116.4 lbs	107.3 lbs
Percent mash.....	58.88%	60.55%	46.41%	61.67%	52.96%
Percent scratch.....	41.12%	39.45%	53.59%	38.33%	47.04%
Oyster shell per bird.....	1.18 lbs	1.8 lbs	1.7 lbs	1.97 lbs	1.42 lbs
Grit per bird.....	2.62 lbs	2.57 lbs	3.25 lbs	3.74 lbs	2.42 lbs
Average live weight of toms.	26.05 lbs	26.36 lbs	26.96 lbs	26.1 lbs	26.64 lbs
Average live weight of hens.	16.48 lbs	16.38 lbs	16.7 lbs	15.93 lbs	16.16 lbs
Percent U. S. Prime.....	100%	97.34%	98.81%	98.67%	100%

* 920 lbs. of supplemental pellets included as mash.

** 900 lbs of supplemental rolled barley included as scratch, and 153 lbs. of milk solids included as mash.

* Ration concentrate to scratch (1941) in range period 43.9 to 56.1 percent.

Feed costs per	Mash.....	\$2.80	\$3.40
100 pounds	Pellets.....	2.85	3.50
First column	Concentrate.....	3.12	4.04
has 1941 figures;	Scratch.....	1.885	2.09
Second column,	Barley supplement.....	1.48	1.50
1942 figures.	Milk (liquid).....	0.25

Table 4. WEIGHTS AND FEED CONSUMPTION, MASH vs. PELLETS

1940 Data

	Pen 1	Pen 2
	Mash & Scratch	Pellets and Scratch
Number of birds.....	89	98
Age at marketing (days).....	206	203
Feed per pound gain (pound).....	4.5	4.4
Feed cost per pound gain (cents).....	8.7	8.9
Total feed consumption per bird (pound)	76.1	77.0*
Percent mash or pellets.....	57.2	62.6
Percent scratch(percent).....	42.8	37.4
Average live weight of toms (pound)....	20.6	21.2
Average live weight of hens (pound)....	13.5	13.6
Percent U. S. Prime (percent).....	86.6	79.6

* Includes 3.6 pounds of mash fed in brooder house.

Feed costs: Scratch.....\$ 1.47 per cwt.
 Mash starter..... 2.52 " "
 Mash developer..... 2.27 " "
 Mash fattener..... 2.09 " "
 Pellet starter..... 2.66 " "
 Pellet developer.... 2.37 " "
 Pellet fattener..... 2.16 " "

Feed costs do not include alfalfa.

Table 5. FEED CONSUMPTION OF LIGHTED AND UNLIGHTED BREEDER BIRDS

1942 data

	Lighted Pens	Unlighted Pens
Number of birds.....	26*	26*
Length of season - days.....	108	108
Pounds of mash.....	450	300
Pounds of scratch.....	810	900
Total pounds of feed consumption.....	1260	1200
Pounds of feed per bird per day.....	0.45	0.43
Pounds of feed per 100 eggs produced...	105	167

* Includes 2 Toms

Table 6. FORMULAS OF WAR-TIME EMERGENCY GROWER RATIONS

	1943			1944				1945			
	Lot 1 Pre-war	Lot 2 Emer- gency	Lot 3 Emer- gency	Lot 1 Pre-war	Lot 2 Emer- gency	Lot 3 Emer- gency	Lot 4 Concen- trate	Lot 1 Pre-war	Lot 2 Emer- gency Soy- bean	Lot 3 Emer- gency soybean & pure vitamin	Lot 4 Concen- trate
	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Linseed oil meal.....	—	—	—	—	—	100	—	—	—	—	—
Soybean oil meal.....	—	240	430	—	400	360	400	—	200	250	200
Bran.....	300	300	300	300	110	—	110	300	200	200	220
Mill run.....	—	—	—	—	200	300	—	—	—	—	—
Ground yellow corn.....	300	300	300	300	300	300	—	300	300	300	—
Ground wheat.....	330	200	100	330	200	200	—	330	310	305	—
Ground oats.....	200	200	200	200	200	200	—	200	200	200	—
Ground barley.....	200	200	200	200	100	100	—	200	200	200	—
Meat meal (50%).....	100	50	20	100	70	70	70	100	100	100	100
Fish meal (67%).....	200	100	40	200	—	—	—	200	100	100	100
Dried skim milk.....	50	50	10	50	20	—	20	50	50	25	50
Dried whey.....	50	50	50	50	20	—	20	50	—	—	—
Distiller's dried solubles.	—	—	50	—	80	80	80	—	50	25	50
Riboflavin mix.....	—	—	—	—	—	3	—	—	—	5	—
Alfalfa leaf meal.....	200	200	200	200	200	200	200	200	200	200	200
Steamed bone meal.....	30	50	60	30	40	—	40	30	30	30	30
Oyster shell flour.....	—	—	—	20	40	40	40	20	40	40	40
Raw rock phosphate.....	—	—	—	—	—	65	—	—	—	—	—
Salt.....	20	20	20	20	20	20	20	20	20	20	10
Limestone.....	16	16	16	—	—	—	—	—	—	—	—
Fish liver oil (800D-4000A)	4.4	4.4	4.4	6.6	6.6	6.6	6.6	7.5	7.5	7.5	7.5
Manganese sulphate.....	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz	4 oz
Total	2000.4	2000.4	2000.4	2006.6	2006.6	2044.6	1006.6	2007.5	2007.5	2007.5	1007.5
Percent protein								20.02	19.95	20.07	30.73

Table 7. PRE-WAR vs. WAR-TIME EMERGENCY RATIONS FOR GROWING TURKEYS

	1943			1944				1945			
	Lot 1	Lot 2	Lot 3	Lot 1	Lot 2	Lot 3	Lot 4	Lot 1 Pre- War	Lot 2 Soy- bean	Lot 3 Soybean Pure Vitamin	Lot 4 Concen- trate
Number of toms.....	37	51	62	65	64	85	46	103	94	90	66
Number of hens.....	77	70	55	73	74	81	53	80	—	—	—
Age in days at marketing.. .days	185	185	185	195	195	195	195	206	206	206	206
Feed per pound gain.....pounds	4.32	4.56	4.39	4.44	4.64	4.68	4.76	5.24	5.13	5.23	5.06
Feed cost per pound of gain*cents	14.30	14.77	14.50	16.05	16.50	16.14	17.97	18.09	17.76	17.62	17.78
Cost per cwt of mash.....dollars	3.538	3.514	3.584	3.831	3.739	3.586	4.458	3.77	3.78	3.64	4.32
Total pounds feed per bird..pounds	71.3	78.4	79.7	81.3	87.3	89.0	94.5	103.4	106.4	109.5	106.4
Percent mash.....percent	69.3	64.3	66	65.4	65.1	63.6	45.4	58.6	59.4	58.6	40.4
Average live weight of toms.pound	20.6	21.6	20.3	22.44	23.39	22.77	24.63	23.8	25.6	26.3	26.7
Average live weight of hens.pound	14.0	13.9	14.4	14.86	15.13	15.36	14.11	15.8	16.2	16.5	17.1
Percent U. S. Prime.....percent	—	—	—	100	97.1	95.2	99	—	—	—	—
Percent Protein in mash..percent	—	—	—	—	—	—	—	20.00	19.95	20.07	30.73

Cost of scratch
\$2.563 per cwt.

Cost of scratch
\$2.863 per cwt.

Cost of scratch
\$2.97 per cwt.

* Feed cost includes grit and shell

Table 8. FORMULA OF EMERGENCY BREEDER RATI0NS

	1943			1944			1945		
	Lot 1 Pre- War*	Lot 2 Emer- gency	Lot 3 Emer- gency	Lot 2 Emer- gency	Lot 3 Emer- gency	Lot 4 Concen- trate	Lot 2 Emer- gency	Lot 3 Emer- gency	Lot 4 Concen- trate
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Bran.....	300	300	300	110	—	—	200	200	220
Mill run	—	—	—	200	300	200	—	—	—
Ground Yellow corn.....	300	300	300	300	300	—	300	300	—
Ground wheat.....	380	300	250	300	300	—	310	300	—
Ground oats.....	250	250	250	200	200	—	200	200	—
Ground barley.....	100	100	100	100	100	—	100	200	—
Soybean oil meal.....	—	150	250	260	300	260	200	250	200
Meat meal.....	100	50	25	40	40	40	100	50	100
Fish meal.....	100	50	25	40	40	40	100	100	100
Dried milk.....	100	100	25	20	—	20	100	50	50
Dried whey.....	100	120	100	40	—	40	—	—	—
Distiller's dried solubles.....	—	—	70	80	100	80	100	50	50
Synthetic vitamin mix.....	—	—	—	—	5	—	—	10	—
Alfalfa leaf meal.....	200	200	200	200	200	200	200	200	200
Oyster shell flour.....	10	10	10	40	40	40	40	40	40
Steam bone meal.....	40	50	70	40	—	40	30	30	30
Salt.....	20	20	20	20	20	20	20	20	10
Dry live yeast.....	—	—	—	10	—	—	—	—	—
Rock phosphate.....	—	—	—	—	53	—	—	—	—
Vitamin oil (2000A-800D).....	6**	6	6	6.6	6.6	6.6	10	10	10
Manganese sulphate.....	1/4	1/4	1/4	1/4	1/4	1/8	1/4	1/4	1/4
Total	2006	2006	2001	2006.6	2004.6	986.6	2010	2010	1010

* Same also in 1944 and 1945.

** Amount increased in succeeding years to amounts in emergency rations.

Table 9. PRE-WAR vs. WAR-TIME EMERGENCY RATIOS FOR BREEDER TURKEYS

	1943 Data				1944 Data**			
	Pen 1 + Pre-War Standard	Pen 2 + Emergency No. 1	Pen 3 + Emergency No. 2	Small * Type Whites	Pen 1 Pre-War Standard	Pen 2 Emergency No. 1	Pen 3 Emergency No. 2	Pen 4 Concen- trate
Number hens started.....	15	15	15	12	21	21	20	20
Mortality number.....	---	---	---	---	---	---	---	---
Number eggs produced.....	544	563	590	418	833	839	729	658
Number eggs per hen.....	36.3	37.5	39.3	34.8	39.7	40.0	36.5	32.9
Percent fertility.....	63.31	70.40	68.46	---	73.7	65.8	65.8	76.7
Percent hatchability..... (Percent those fertile)	79.40	78.42	81.25	---	82.1	70.1	78.3	71.1

+ 73 days' production pens 1 - 2 - 3.

** 77 days' production

* 65 days' production pens whites.

	1945 Data					1946 Data				
	Pen 1 Pre- War	Pen 2 Emer- gency	Pen 2-A Emergency	Pen 3 Emer- gency	Pen 4 Concen- trate	Pen 1 Pre- War	Pen 2 Emer- gency	Pen 2-A Emergency Added vitamin	Pen 3 Emer- gency	Pen 4 Concen- trate
Number hens started.....	20	20	20	20	20	22	22	13	22	22
Mortality number.....	---	1	---	1	---	---	---	---	---	---
Number eggs produced.....	714	847	931	702	761	415	432	271	325	394
Number eggs per hen.....	33.9	42.4	46.6	34.0	37.5	18.9	19.6	20.8	14.8	17.9
Percent fertility.....	78.1	75.2	73.9	88.2	87.6	83.2	81.1	55.5	73.2	80.7
Percent hatchability.....	73.0	70.6	69.7	68.8	78.8	80.6	75.2	75.7	81.1	75.0

83 days' production

46 days' production

Table 10. COMPARISON OF STANDARD BRONZE, BROAD BREASTS, AND SMALL TYPE WHITE TURKEYS

	1940			1941			1942			1943
	Standard Bronze	1/2 Blood Broad- breast	Late Maturing Bronze	Stan- dard Bronze	3/4 Blood Broad- breast	Broad- breast	Stan- dard Bronze	Broad- breast	Small Type Whites	Small Type Whites
Age in days at marketing....days	201	200	242	210	210	210	216	216	207	189
Feed per pound of gain.....	4.1#	3.9#	4.8#	4.9#	4.8#	4.8#	5.2#	4.7#	5.1#	5.75#
Feed cost per pound of gain.....	7.9¢	7.5¢	8.9¢	12.0¢	11.9¢	11.9¢	15.1¢	13.8¢	14.4¢	18.4¢
Total pounds of feed consumption	6200#	6192#	6375#	4923#	5733#	1857#	4999#	3605#	7007#	4025#
Percent mash.....	58.1%	56.0%	50.2%	56.3%	60.1%	54.8%	60.3%	66.3%	56.1%	66.7%
Percent scratch.....	41.9%	44.0%	49.8%	43.7%	39.9%	45.2%	39.7%	33.7%	43.9%	33.3%
Average live weight of Toms.....	24.3#	23.9#	23.1#	25.3#	25.4#	25.3#	24.7#	25.5#	16.5#	14.5#
Average live weight of Hens.....	15.7#	15.7#	13.5#	15.8#	15.8#	16.2#	14.4#	14.4#	8.9#	8.3#
Percent U. S. Prime.....	88.0%	83.3%	91.3%	97.9%	94.4%	92.9%	—	—	—	—
Cost of mash per cwt.....dollars	2.27	2.27	2.27	2.80	2.80	2.80	3.40	3.40	3.40	3.53
Cost of scratch per cwt..dollars	1.47	1.47	1.47	1.89	1.89	1.89	2.09	2.09	2.09	2.56

Table 11. ARTIFICIAL LIGHTS WITH AND WITHOUT SHELTER
vs.
TURKEY BREEDING STOCK WITHOUT LIGHTS AND WITHOUT SHELTER

	Three-Year Results 1939-40-41		One-Year Results 1942	
	Lights and Shelter	No Lights or Shelter	Lights No Shelter	No Lights or Shelter
Average number of hens per pen.....	24	24	22	22
Average length of laying period.....days	86	51	72	48
Average date of first egg.....	Feb. 1	Mar. 8	Feb. 17	Mar. 13
Days from lights to 50% lay for lighted pen.....	32	----	34	----
Average number of eggs per hen.....	55*	36*	45*	33*
Percent production during each laying period.....%	64	71	63	68
Percent fertility.....%	77.8	85.5	77.5	76.8
Percent hatchability of fertile eggs.....%	76	76.6	86.3	77.4
Percent mortality of poults to 6 weeks.....%	6.1	7.8	3.9**	2.9**

* Includes only eggs suitable for setting (excludes small, odd shaped and double yolk).

** Based on mortality first 2 weeks only.

	<u>1939-40-41</u>	<u>1942</u>
Date lights turned on.....	January 1	January 13
Date trapnesting discontinued....	April 30	April 30