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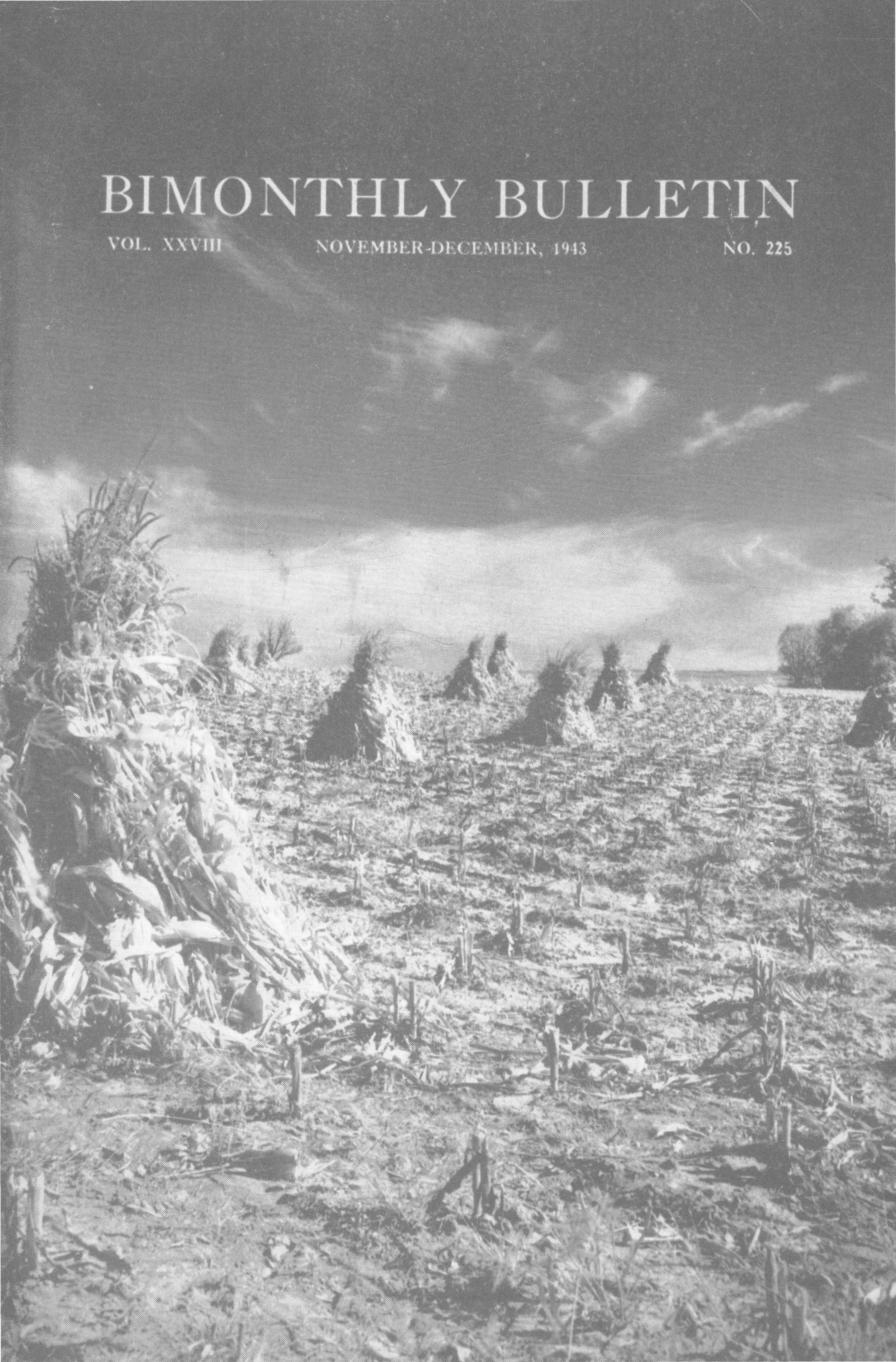

YOUR AUTHORS

Already familiar to Bimonthly Bulletin readers are the authors of this issue: D. C. Kennard, poultry specialist, Alex Laurie of the Division of Floriculture, F. L. Morison and J. I. Falconer of the Department of Rural Economics.

The cover photograph is another in the series by Harry G. Binau, Experiment Station photographer.

IN THIS ISSUE

THIN-SHELLED EGGS, THEIR CAUSES AND REMEDIES

D. C. KENNARD AND V. D. CHAMBERLIN

Thin- or weak-shelled eggs cause trouble for egg producers, egg handling and marketing agencies, hatcheries, and consumers. Great market losses occur from cracked or broken weak-shelled eggs. Thin-shelled eggs break in nests, fouling other eggs and the nesting material. Such eggs break in gathering containers and egg cases, foul other eggs and the containers. Some poor-shelled eggs may reach the consumer. Thin-shelled eggs are unfit for hatching or cold storage. Furthermore, weak-shelled eggs are primarily responsible for hens' eating their eggs.

Principal causes for thin-shelled eggs are deficient diet, warm weather, advanced age of layers, and heredity.

Since egg shells are about 94 per cent calcium carbonate and constitute about 30 per cent of the total solids of normal eggs, the first and principal mineral requirement for egg shell formation is calcium carbonate, which is generally provided by keeping oyster shells or 90 to 95 per cent calcium carbonate limestone grit before layers at all times. In addition, layers must have ample vitamin D to render the calcium available for assimilation into egg shell material. Regardless of how much oyster shell or limestone material the layer consumes, the calcium is useless without an adequate amount of the vitamin D factor to render it available for egg shell formation.

When eggs are broken in nests or hens are seen eating eggs, the poultryman should examine a number of the eggs to see whether they are thin shelled. The thin shell condition comes on gradually and often escapes notice until the trouble stage has been reached. If there is evidence of poor shell texture, the first causes to suspect and correct are dietary deficiencies. When the diet is responsible with layers confined indoors, the cause is probably a deficiency of vitamin D, if the layers have access to oyster shells or 90 to 95 per cent calcium carbonate limestone grit at all times.

The vitamin D factor, as provided by direct sunshine, sunlamps, vitamin D feeding oil, or other vitamin D supplements, is necessary in the diet to enable the layers to assimilate the necessary calcium for egg shell formation and other body functions. The supplemental requirement for layers in general, including breeders, from October 1 to April 1 when confined indoors is 350 to 450 AOAC chick units per pound of total feed intake. The requirement for hatchable eggs is greater than for market egg production. The four principal causes of vitamin D deficiency are:

Failure of layers to consume sufficient mash, which contains the vitamin D supplement, when whole grain is fed unrestricted in addition to the mash

Insufficient vitamin D supplement in the mash

Deterioration of the vitamin D after preparation of the mash

Lack of potency of the vitamin D supplement

A case of lack of potency of the vitamin D supplement occurred at the Ohio Agricultural Experiment

Station in February 1935. The feeding oil in use did not contain its guaranteed content of vitamin D, a not uncommon experience before the more dependable standardization of vitamin D supplements. When a large proportion of the eggs from layers in batteries had weak or thin shells and many were lost from breakage, the amount of vitamin D feeding oil in the mash was doubled, and the condition of the egg shells promptly improved.

Poultrymen troubled with poor shell texture of eggs from layers confined indoors should determine whether the trouble is due to a deficiency of vitamin D in the hens' diet by doubling the amount of vitamin D feeding oil or other vitamin D supplement used. If after 4 weeks there is a noticeable improvement in the condition of the egg shells, the cause of the poor-shelled eggs is obvious. If no improvement in the egg shell texture is observed, it can be assumed that the trouble is due to some other cause. Usually, however, insufficient mash consumption to provide the necessary amount of vitamin D or an insufficient addition of the vitamin D supplement to the mash is the cause.

Deficiency of vitamin D and poor shell texture are generally most acute from January to May. Layers in batteries are more subject to a deficiency of vitamin D than those confined to indoor floor pens; layers with an opportunity to be out of doors during the winter months when weather permits are seldom affected.

Poor egg shell texture beyond immediate means of prevention or control may be caused from failure of the egg shell-forming organs to function properly because of disease complications affecting the oviducts.

An extreme instance of poor shell texture, apparently due to disease complications affecting the oviducts or shell-forming organs, occurred in a group of the Station's Leghorn pullets in batteries in 1932. This group of pullets was part of an experiment in which pullets were purposely raised on disease- and parasite-contaminated range in comparison with other groups of similar pullets raised on clean range or confined to wire sun porches. So many of the eggs from the pullets raised on the contaminated range had thin shells that 14.3 per cent of the eggs laid from December 5 to August 25 passed through the wire bottoms of the batteries. In fact, many of the eggs were soft shelled (shell-less). In contrast, less than 1 per cent of the eggs from the other groups were soft shelled. In addition, the pullets not exposed to contaminated soil laid 40 more eggs per bird (including the 14.3 per cent lost eggs), or 56 more marketable eggs per bird during 38 weeks, and the mortality rate was approximately one-half that of the pullets raised on contaminated soil. Although this was an extreme, perhaps unusual, instance of poor-shelled eggs apparently due to disease complications affecting the shell-forming organs, such cases may occur in varying degrees of intensity in farm and commercial laying flocks without being recognized. It was because the Station's pullets were in batteries that an accurate account of the weak- or soft-shelled eggs could be recorded. There is no way of knowing how many weak- or soft-shelled (shell-less) eggs may be lost in floor pens.

How thin-shelled eggs encourage hens to eat their eggs was demonstrated in some of the Station's early experiments in which some groups of layers confined indoors received a ration with cod-liver oil to provide ample vitamin D, while others received the same ration without the vitamin D oil. After 2 to 3 months, the eggs from the layers on the vitamin D-deficient ration became thin shelled, and the birds started to eat them. Soon few eggs could be collected from this pen. Just as soon as an egg was laid, especially on the floor, the birds scrambled for it. When an egg from the cod-liver oil pen was put on the floor of the pen of the layers not receiving cod-liver oil and withstood their attack, the egg eaters gave up their attempts at egg eating. Of course, some poor management procedures, such as faulty and inadequate nesting equipment, too much light in nests, overcrowded nests and broken eggs, failure to gather eggs frequently, and floor eggs, are also responsible for egg eating.

Many egg producers have experienced as much difficulty in securing oyster shells or 90 to 95 per cent calcium carbonate limestone grit to produce the shell of the egg as in securing some of the other feedstuffs to produce the contents.

A suitable source of lime or calcium is as essential for egg production as any part of the hen's diet. The calcium for egg shell formation is generally provided by oyster shells or 90 to 95 per cent calcium carbonate limestone grit. When layers do not have free access to oyster shells or high-calcium limestone grit, reduced egg production, thin-shelled eggs, and egg eating generally follow. Consequently, poultrymen should consider it as important to keep the layers provided with oyster shells or 90 to 95 per cent calcium carbonate limestone grit as to keep them provided with a well-balanced mash and whole grain. The same applies to feed merchants.

Poultrymen who are unable to secure oyster shells may be able to secure 90 to 95 per cent calcium carbonate limestone grit. Unfortunately, high-calcium limestone grit suitable for feeding poultry often must be transported long distances, because there is little or no limestone sufficiently high in calcium which is suitable and available for feeding poultry in large sections of the country, including Ohio. Dolomitic limestone, which contains too much magnesium for feeding poultry, is readily available in many sections of the country, including Ohio, but it should not be used for feeding poultry except as a last resort when it is temporarily impossible to secure oyster shells or 90 to 95 per cent calcium carbonate limestone grit.

Oyster shells or 90 to 95 per cent calcium carbonate limestone grit can be included in the mash at the rate of 5 per cent in all-in-one, complete feed mixtures for layers in batteries, or, for layers in general, 1 to 2 per cent can be added to the laying mash for special purposes in addition to the free-choice feeding of oyster shells or high-calcium limestone grit. When either product is added to the mash, the shell flakes or the grit, rather than the pulverized products, should be used.

The purpose of feeding high-calcium limestone grit is for its calcium, and hard grit, such as mica, quartz, or granite, which contains no calcium carbonate, cannot substitute for oyster shells or high-calcium limestone grit. There appears to be little evidence that hard grit is essential for layers kept under practical conditions of feeding and management.

SUMMARY

The two dietary requirements which call for special attention in avoiding thin-shelled eggs are: keeping oyster shells or 90 to 95 per cent calcium carbonate limestone grit available for the layers at all times and providing ample vitamin D in

the diet or sufficient exposure of the layers to direct sunlight to render the calcium available for egg shell formation. Oyster shells or 90 to 95 per cent calcium carbonate grit is as necessary as any part of the hen's ration for egg production. When layers do not have free access to oyster shells or 90 to 95 per cent calcium carbonate grit at all times, or if the diet of hens confined indoors is deficient in vitamin D, thin-shelled eggs, loss of egg production, and hens' eating their eggs are natural consequences.

When eggs from layers confined indoors show signs of poor shell texture, or there is undue loss of eggs from breakage or from hens' eating their eggs, a deficiency of vitamin D is the first cause to be suspected and corrected (assuming, of course, that the layers have free access to oyster shells or 90 to 95 per cent calcium carbonate limestone grit at all times). If additional vitamin D supplement fails to improve the egg shell texture, the cause can be considered due to other factors, over which the poultryman may have no immediate means of prevention or control.

GERMINATION OF BELLADONNA SEED AND EFFECT OF WINTER MULCHES ON PLANT MORTALITY

ALEX LAURIE

SEED GERMINATION

Seed germination of belladonna has not been high, averaging 25 to 40 per cent and sometimes even lower. The tests reported in this article were made to determine the causes and methods of improvement.

The best germination occurred from seed which matured on the plants by being allowed to stay until the seed pods were dry. Under such conditions the seeds are large, well filled, dark colored, and shiny. A certain percentage of seeds harvested from unripe fruits will germinate, however. Cutting tests indicate that dark embryos and endosperms are not objectionable and have little to do with usability.

The need for covering flats depends on the type of medium used. Mediums which dry out readily should be covered to retain moisture about the seeds. For that purpose subirrigation of flats is desirable.

In order to increase germination percentages, several treatments were tried. They were: precooling seeds, based on the assumption that an after-ripening period may be needed; soaking in water; use of sulfuric acid and hydrochloric acid to soften the seed coats; high temperature and moisture. All seed was sown in light loam soil. The results are as given in table 2.

The figures in table 2 are composite for numerous trials. Cooling at 45° F. for a period of several

TABLE 1.—Covering seed flats

Medium	Covered with glass		Uncovered	
	Percentage germination	Days	Percentage germination	Days
Soil	48	23	22	26
Sphagnum	51	13	54	14
Peat	11	30	5	20
Sand	52	25	42	20

TABLE 2.—Seed germination

Treatment	Percentage germination	Days to germinate
Check	25	35
Cooling 2 weeks, 45°	29	39
Cooling 5 weeks, 45°	47	52
Water 7 days, 50°	35	33
Water 7 days, 60°	50	30
Soil 7 days, 60°	55	19
Moist burlap, 90°, 7 days	65	16
Moist soil, 90°, 7 days	89	8
Sulfuric acid, 1 minute	52	10

weeks before sowing had some effect on increasing germination. However, treatment with sulfuric acid, commercial strength (70 per cent), with 1 minute immersion was more effective than cooling and reduced germination time considerably. Of all the treatments tried, high temperature combined with high soil moisture gave the highest germination (in some cases close to 100 per cent) and required the least number of days for emergence above ground.

RESULTS OF MULCHING TESTS OVER WINTER

It has been found that belladonna has a higher alkaloid content during its second year of growth than during the first season. For this reason, some growers attempt to winter the plants. Tests have been conducted to determine the feasibility of wintering the plants. Results of the first year's trials are presented in table 3.

TABLE 3.—Effect of depth of mulches on survival

Depth	Percentage survival
Heavy mulch (12 inches of strawy manure)	76
Medium mulch (6 to 8 inches of strawy manure)	60
Light mulch (3 to 4 inches of strawy manure)	57
No mulch	9

These tests were conducted on silt loam soil. In heavier soils the survival was less, depending on the amount of clay present and the depth of mulch. Without mulching, practically every plant died in heavy soils. Yet extremely heavy mulches (12 inches) likewise resulted in great loss, largely due to excess moisture present. In heavy soils a 6-inch mulch would be more desirable.

Fertilizer treatments likewise have their effect on survival of plants during the winter. Table 4 illustrates results of various fertilizer treatments. A 6-inch mulch was used on all plots in light loam soil.

TABLE 4.—Effect of mulches on survival of 1-year belladonna plants at different nutrient levels

pH 5.5-6.5		pH 6.5-7.5	
Treatment	Percentage survival	Treatment	Percentage survival
High N, high P, high K*	60	High N, high P, high K	60
Low N, high P, high K	93	Low N, high P, high K	87
High N, low P, low K	48	High N, low P, low K	50
Low N, low P, low K	80	Low N, low P, low K	85
High N, low P, high K	40	High N, low P, high K	33
Low N, low P, high K	85	Low N, low P, high K	76
High N, high P, high K	40	High N, high P, low K	40
Low N, high P, low K	85	Low N, high P, low K	85

N, nitrogen; P, phosphate; K, potassium.

One year's tests show a consistent trend indicating that high nitrogen content is conducive to greater loss during the winter. Maintenance of low nitrogen levels, particularly toward the last of the season, is a desirable practice. No significant effects were observed from varying the levels of phosphorus and potassium.

In general, it would be assumed that carrying belladonna over winter necessitates mulching and low levels of nitrogen. However, since sufficiently high assays are secured from 1-year-old plants, the additional cost of mulching may be questioned.

Mulching tests with several species of digitalis on Fox silt loam showed the results given in table 5. The mulches were 6 inches deep.

TABLE 5.—Effect of mulching on several species of digitalis

	Mulched, percentage survival	Not mulched, percentage survival
Digitalis purpurea	53	9
lutea	100	100
lanata	47	80
ambigua	100	81

UTILIZATION OF OHIO FARM FEED SUPPLIES

F. L. MORISON

The Department of Rural Economics of the Ohio Agricultural Experiment Station was one of several agencies participating in a recent study on "Maximum Wartime Agricultural Production in Ohio." In this study it was necessary to make estimates of the present and probable future amounts of feed consumed by Ohio livestock. For the year beginning October 1, 1942, it was estimated that nearly 6 million tons of feed grains, mill feeds, and other concentrates were consumed on Ohio farms. This tonnage was about 11 per cent greater than was fed in the previous year. A large part of the increase went to hogs and poultry.

TABLE 1.—Estimated percentage of total tonnage of grains and commercial feeds fed to each class of livestock on Ohio farms in the years beginning October 1, 1941-1942

Class of livestock	1941	1942
Horses, mules, and colts	5.6	4.7
Milk cows	16.7	15.3
Feeder cattle	3.6	3.3
Other cattle and calves	6.6	6.2
Feeder lambs	.5	.4
Other sheep and lambs	1.2	1.1
Hogs	45.4	48.9
Hens and pullets	13.2	13.0
Chickens raised	6.5	6.4
Turkeys	.7	.7
Total	100.0	100.0

Table 1 shows what share of the total grain supply went to each class of livestock during the last two crop years. The increased percentage going to hogs in the year beginning October 1, 1942, and how this reduced the share going to other classes, particularly milk cows, should be noted.

TABLE 2.—Estimated percentage of total hay supply fed to each class of livestock on Ohio farms in the years beginning October 1, 1941-1942

Class of livestock	1941	1942
Horses, mules, and colts	18.6	17.3
Milk cows	49.0	49.7
Feeder cattle	2.0	2.0
Other cattle and calves	17.5	18.2
Feeder lambs	1.1	1.0
Other sheep and lambs	11.8	11.8
Total	100.0	100.0

The relative amounts of the hay supply going to various classes of livestock are shown in table 2. Approximately 3½ million tons of hay are fed annually. Of this total, horses receive about one-sixth, milk cows about one-half, all other cattle about one-fifth, and sheep about one-eighth.

INDEX NUMBERS OF PRODUCTION, PRICES, AND INCOME

J. I. FALCONER

Four years after the beginning of World War I, the price level had risen 96 per cent; it is now 4 years since the beginning of the present war, and the general price level has advanced by 33 per cent.

Trend of Ohio prices and wages

1910-1914=100

	Wholesale prices, all commodities U. S.	Ohio industrial pay rolls 1935-1939 =100*	Prices paid by farmers	Farm products prices U. S.	Ohio farm wages	Ohio farm real estate	Ohio farm products prices	Ohio cash income from sales
1913........	102	....	101	101	104	100	105	101
1914........	99	....	100	101	102	102	105	109
1915.......	102	....	105	98	103	107	106	112
1916.......	125	....	124	118	113	113	121	123
1917........	172	....	149	175	140	119	182	201
1918.......	192	....	176	202	175	131	203	243
1919.......	202	....	202	213	204	135	218	270
1920... ...	225	....	201	211	236	159	212	230
1921........	142	....	152	125	164	134	132	134
1922.......	141	....	149	132	145	124	127	133
1923.......	147	....	152	142	160	122	134	147
1924.......	143	....	152	143	165	118	133	150
1925.......	151	....	156	156	165	110	159	180
1926	146	....	155	145	170	105	155	183
1927.......	139	....	153	139	173	99	147	171
1928........	141	....	155	149	169	96	154	163
1929........	139	....	154	146	169	94	151	172
1930........	126	....	146	126	154	90	128	142
1931........	107	84	126	87	120	82	89	105
1932........	95	58	108	65	92	70	63	77
1933........	96	61	108	70	74	59	69	87
1934........	110	77	122	90	77	63	85	102
1935........	117	87	125	108	87	66	110	132
1936........	118	102	124	114	100	71	118	152
1937........	126	120	131	121	118	75	128	164
1938........	115	87	123	95	117	74	103	140
1939........	113	103	121	93	117	76	95	140
1940........	114	117	122	98	116	77	99	146
1941........	127	170	131	122	138	80	121	185
1942........	144	227	154	157	173	89	157	244
1942								
January....	140	192	146	149	153	......	141	201
February..	141	199	147	145	....	....	144	183
March....	142	208	150	146	....	89	146	208
April.......	144	210	151	150	167	....	153	230
May.......	144	216	152	152	....	....	157	241
June.......	144	222	152	151	176	......	157	232
July........	144	230	152	154	179	....	159	237
August ...	145	233	152	163	....	....	164	248
September.	145	237	153	163	....	....	161	268
October ...	145	249	154	169	193	....	165	290
November.	146	258	155	169	....	....	167	293
December.	147	267	156	178	....	....	169	297
1943								
January ...	149	268	158	182	196	......	174	283
February..	149	275	160	178	....	....	177	261
March.....	150	282	161	182	....	97	181	287
April.......	151	284	162	185	212	....	190	296
May.......	152	289	163	187	....	....	197	318
June.......	151	293	164	190	221	......	193	318
July........	150	291	165	188	229	......	192	320
August ...	150	....	165	193	....	....	198	333

*SOURCE: Bureau of Business Research, The Ohio State University.

INDEX TO VOLUME XXVIII, 1943