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PIP Progress In Poultry
"THROUGH RESEARCH"

# STRAIN/SEASON RELATIONSHIPS FOR EGG PRODUCTION, FEED CONSUMPTION, FEED CONVERSION, AND MORTALITY IN COMMERCIAL EGG PRODUCTION FLOCKS

In 1977 and 1979, studies were conducted to determine seasonal effects on various performance characteristics in commercial laying flocks in California. Weekly records of egg production, mortality, and feed consumption were assembled from 504 flocks representing six years of hatches (1973-1978), 30 commercial farms and more than 27 million hens.

Initial analysis of performance by season of hatch showed very small differences in performance when the period between 20 and 60 weeks of age was totaled (Table 1).

Summary of the data by season of hatch and age revealed important variations in early production, mortality, feed consumption, and feed conversion (Table 2). None of these data were tested for statistical significance.

TABLE 1. Effect of season of hatch on performance.

| Season of Hatch | No. of Flocks | Eggs Per Hen-Housed (21-60 wks) | Hen-Day Production (21-60 wks) | Total Mortality (21-60 wks) | Flocks | Feed Consumption (26-60 wks) | Feed Conversion (26-60 wks) |
|---|---|---|---|---|---|---|---|
| | | | (%) | (%) | | (g/day) | (lbs/doz) |
| Spring | 125 | 182.8 | 69.2 | 10.6 | 105 | 108 | 3.76 |
| Summer | 125 | 184.0 | 70.0 | 11.0 | 101 | 106 | 3.61 |
| Fall | 122 | 184.1 | 70.5 | 11.3 | 100 | 105 | 3.64 |
| Winter | 132 | 186.6 | 70.8 | 10.2 | 101 | 107 | 3.69 |

TABLE 2. Effect of season of hatch and age on performance.

Hen-Day Production (%)

| | Weeks | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Season of Hatch | 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 |
| Spring | 18.6 | 71.9 | 83.4 | 81.5 | 78.8 | 76.1 | 73.1 | 70.4 |
| Summer | 16.2 | 74.1 | 84.5 | 82.9 | 80.1 | 77.1 | 74.0 | 71.0 |
| Fall | 22.9 | 75.3 | 83.2 | 82.0 | 79.6 | 77.2 | 74.0 | 69.8 |
| Winter | 25.5 | 76.1 | 83.9 | 82.7 | 79.7 | 76.1 | 72.6 | 69.5 |
| Average | 20.9 | 74.4 | 83.8 | 82.3 | 79.5 | 76.6 | 73.4 | 70.2 |

TABLE 2. Effect of season of hatch and age on performance (continued).

| Season of Hatch | Weeks 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 |
|---|---|---|---|---|---|---|---|---|
| **Weekly Mortality (%)** | | | | | | | | |
| Spring | .232 | .286 | .308 | .298 | .285 | .262 | .287 | .293 |
| Summer | .220 | .301 | .365 | .353 | .315 | .302 | .270 | .240 |
| Fall | .339 | .414 | .384 | .327 | .272 | .226 | .220 | .244 |
| Winter | .283 | .317 | .320 | .281 | .260 | .238 | .233 | .248 |
| Average | .268 | .329 | .344 | .314 | .283 | .257 | .253 | .256 |
| **Feed Consumption (g/day)** | | | | | | | | |
| Spring | 78 | 99 | 109 | 111 | 111 | 111 | 109 | 105 |
| Summer | 84 | 104 | 110 | 109 | 107 | 104 | 103 | 102 |
| Fall | 84 | 100 | 105 | 103 | 104 | 106 | 109 | 110 |
| Winter | 79 | 95 | 103 | 107 | 109 | 112 | 113 | 113 |
| Average | 81 | 99 | 107 | 108 | 108 | 108 | 108 | 107 |
| **Feed Conversion (lbs/doz)** | | | | | | | | |
| Spring | 26.46 | 3.71 | 3.47 | 3.62 | 3.75 | 3.87 | 3.92 | 3.94 |
| Summer | 26.66 | 3.65 | 3.44 | 3.50 | 3.55 | 3.59 | 3.70 | 3.82 |
| Fall | 17.22 | 3.56 | 3.32 | 3.31 | 3.47 | 3.66 | 3.90 | 4.23 |
| Winter | 10.83 | 3.29 | 3.22 | 3.41 | 3.63 | 3.87 | 4.12 | 4.29 |
| Average | 20.09 | 3.55 | 3.37 | 3.46 | 3.60 | 3.75 | 3.91 | 4.07 |

Summer-hatched flocks commenced production at a slower rate than winter-hatched flocks. This reflects the season in which normal sexual maturity occurs. Summer-hatched flocks start to lay during a decreasing day length period, while winter-hatched flocks start to lay during an increasing day length period.

A similar pattern was observed in mortality associated with season and peak production. The fall-hatched flocks experienced a very high mortality rate during the first 15 weeks of lay when increasing day length and increasing production rates coincided.

Feed consumption and feed conversion curves reflect the prevalent temperatures at each age. Feed consumption by season varied from ± 3 to 5% of the average rate for each age. Annual averages, though, were practically the same.

Further analyses showed performance variation between strains when season of hatch was considered. Most important of these differences was that associated with mortality (Table 3, and Figures 1 - 5) and hen-housed production (Table 4). Overall, spring-hatched flocks demonstrated a lower rate of early production but seasonal patterns were not consistent between strains (Table 5).

TABLE 3. Weekly mortality rates by strain and season of hatch.

| Strain | Season | Flocks | Weeks 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (%) | | | | | | | | |
| A | Spring | 50 | .224 | .291 | .290 | .288 | .265 | .220 | .230 | .242 | .256 |
| | Fall | 51 | .245 | .403 | .455 | .335 | .269 | .217 | .202 | .199 | .283 |
| | Annual | 227 | .247 | .332 | .348 | .313 | .278 | .249 | .230 | .228 | .278 |
| B | Spring | 16 | .225 | .221 | .203 | .237 | .257 | .227 | .283 | .381 | .254 |
| | Fall | 20 | .246 | .202 | .242 | .230 | .231 | .225 | .239 | .295 | .251 |
| | Annual | 68 | .215 | .206 | .218 | .218 | .234 | .230 | .249 | .319 | .236 |
| C | Spring | 10 | .206 | .218 | .248 | .232 | .221 | .248 | .438 | .254 | .258 |
| | Fall | 15 | .387 | .365 | .293 | .253 | .216 | .201 | .189 | .234 | .270 |
| | Annual | 55 | .275 | .321 | .283 | .268 | .228 | .225 | .266 | .230 | .262 |
| D | Spring | 25 | .268 | .297 | .319 | .316 | .300 | .316 | .294 | .319 | .304 |
| | Fall | 15 | .487 | .444 | .414 | .301 | .280 | .217 | .238 | .224 | .326 |
| | Annual | 70 | .309 | .317 | .345 | .303 | .280 | .265 | .265 | .268 | .294 |
| E | Spring | 8 | .184 | .391 | .563 | .485 | .429 | .405 | .374 | .325 | .395 |
| | Fall | 7 | .237 | .439 | .556 | .485 | .340 | .243 | .225 | .241 | .346 |
| | Annual | 35 | .217 | .366 | .487 | .468 | .390 | .324 | .306 | .290 | .356 |
| All | Spring | 125 | .232 | .286 | .308 | .298 | .285 | .262 | .287 | .293 | .291 |
| | Fall | 122 | .339 | .414 | .384 | .327 | .272 | .226 | .220 | .244 | .303 |
| | Annual | 504 | .268 | .329 | .344 | .314 | .283 | .257 | .253 | .256 | .288 |

Figure 1
MORTALITY RATE/WEEK (%)

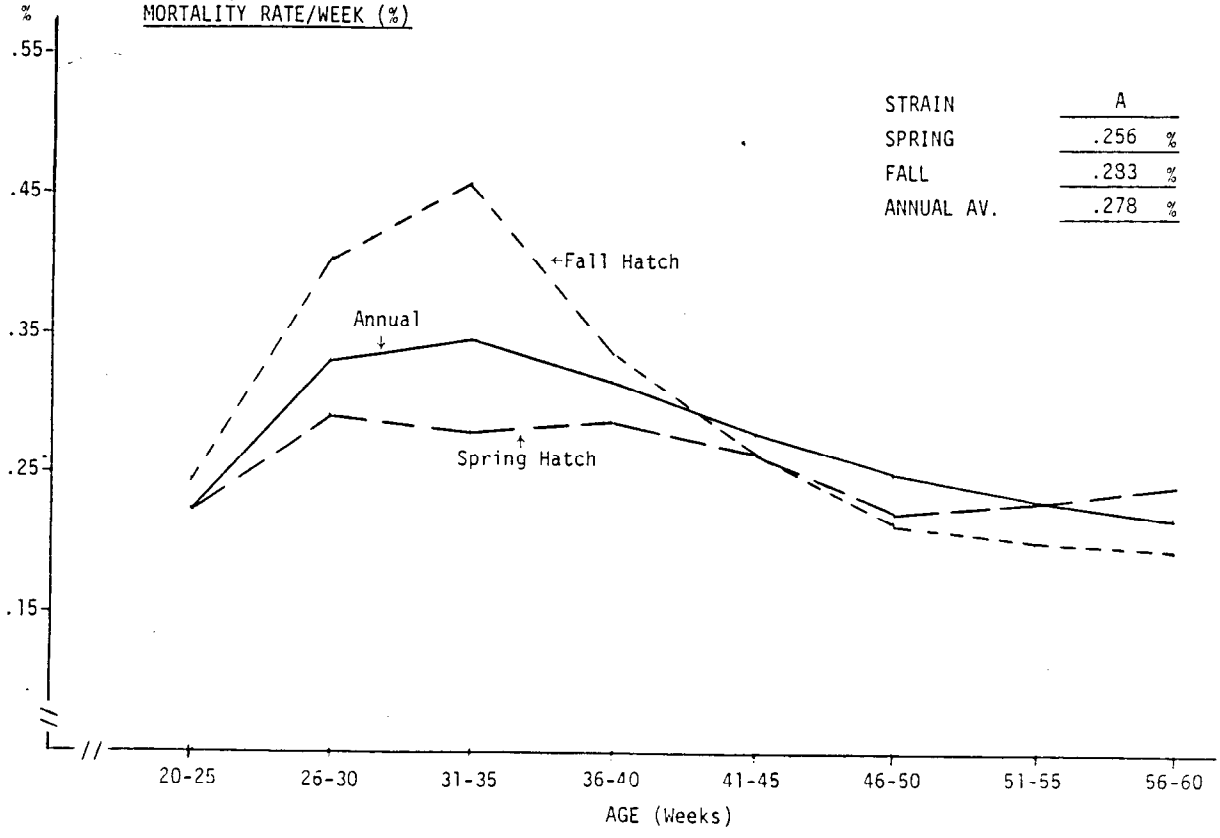


Figure 2
MORTALITY RATE/WEEK (%)

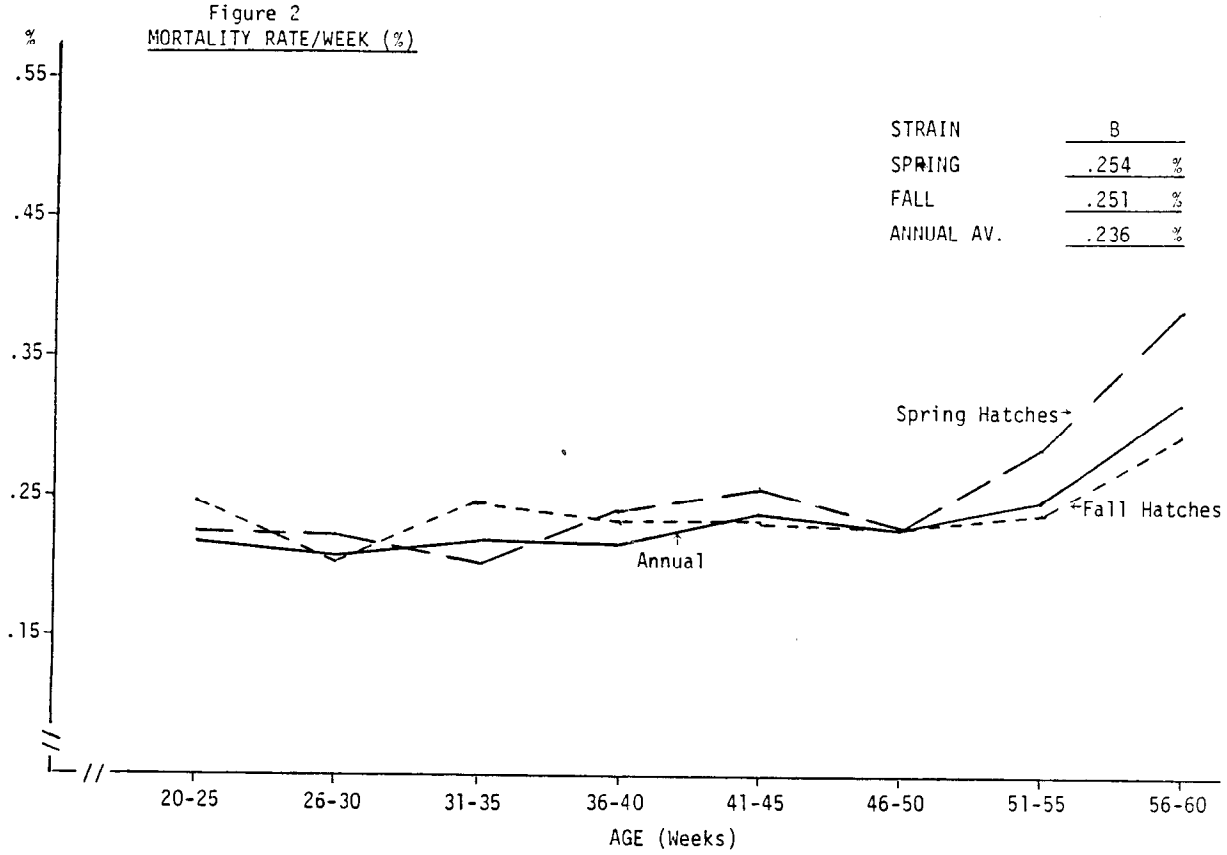
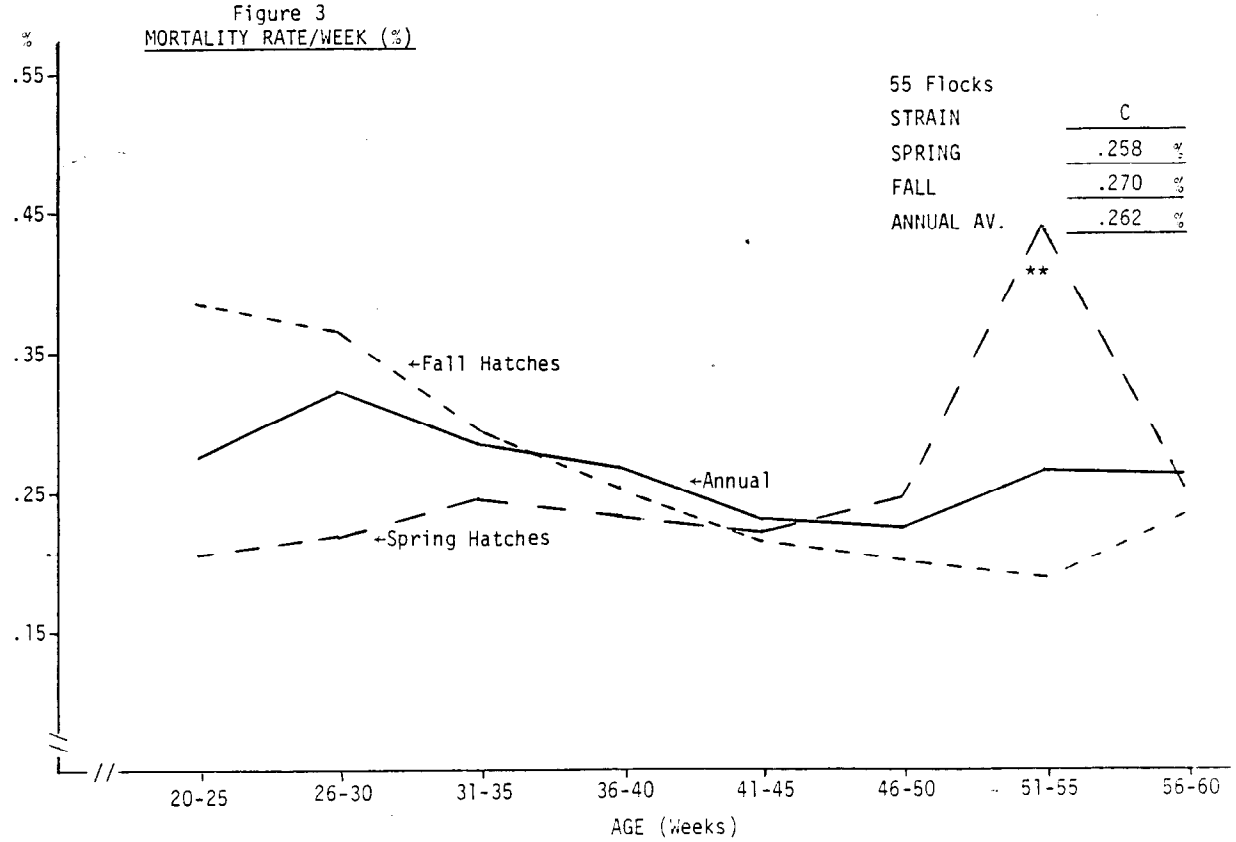



Figure 3
MORTALITY RATE/WEEK (%)




** One flock out of eleven flocks with extremely high mortality.

Figure 4
MORTALITY RATE/WEEK (%)

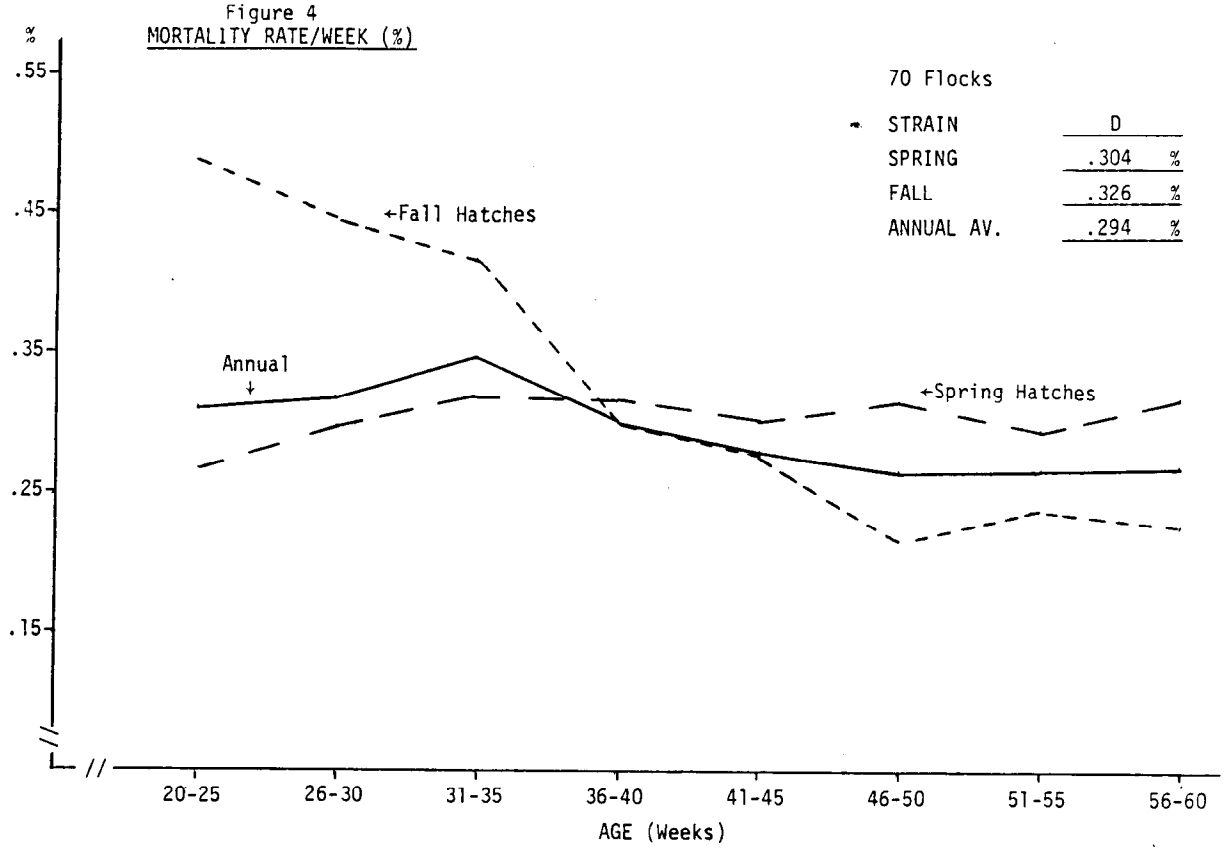



Figure 5
MORTALITY RATE/WEEK (%)

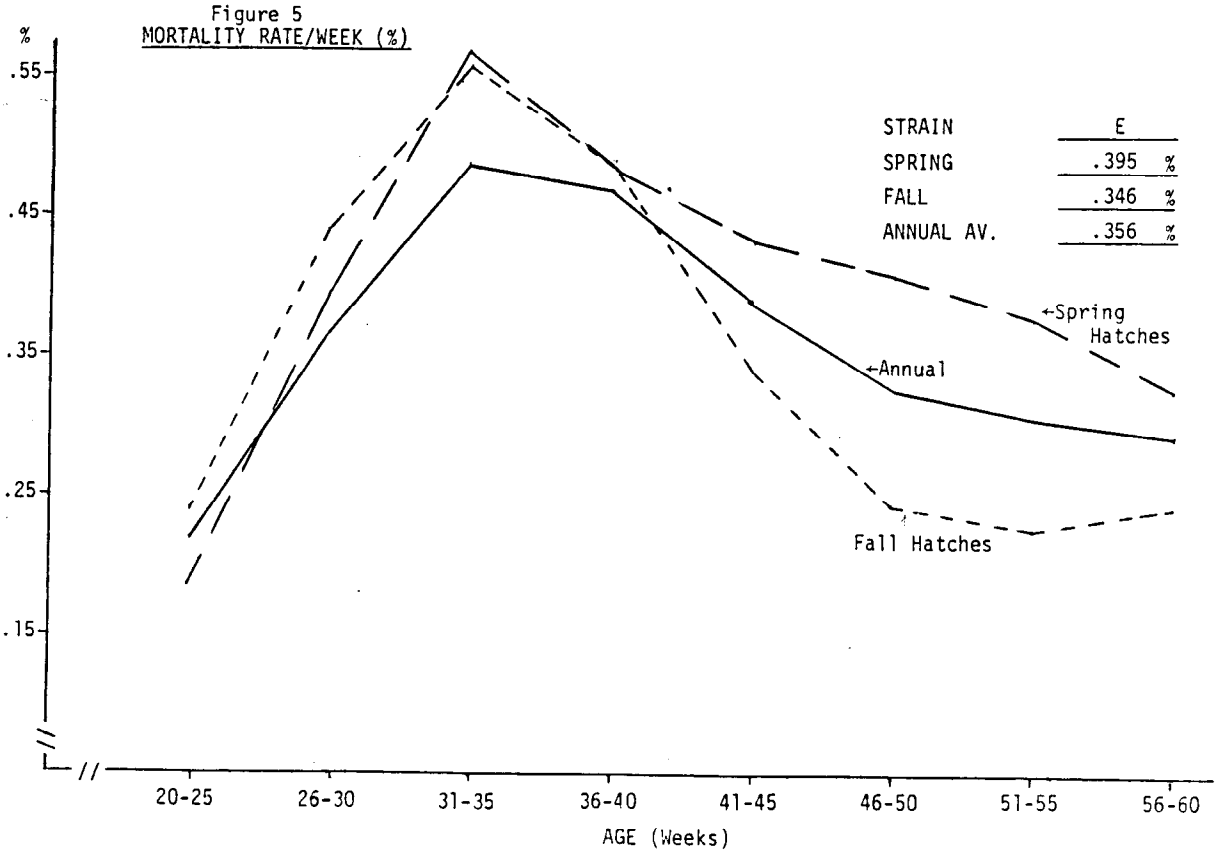


TABLE 4. Hen-housed production by strain and season of hatch.

| Strain | Season | Flocks | Eggs at 60 weeks of age |
|---|---|---|---|
| A | Spring | 50 | 184.8 |
| | Fall | 51 | 186.4 |
| | Annual | 227 | 185.9 |
| B | Spring | 16 | 179.8 |
| | Fall | 20 | 185.2 |
| | Annual | 68 | 184.8 |
| C | Spring | 10 | 191.9 |
| | Fall | 15 | 196.8 |
| | Annual | 55 | 195.1 |
| D | Spring | 25 | 179.7 |
| | Fall | 15 | 177.1 |
| | Annual | 70 | 181.3 |
| E | Spring | 8 | 180.9 |
| | Fall | 7 | 181.1 |
| | Annual | 35 | 181.8 |
| All* | Spring | 125 | 182.8 |
| | Fall | 122 | 184.1 |
| | Annual | 504 | 184.4 |

* Includes others strains.

TABLE 5. Hen-day production by strain and season of hatch.

| Strain | Season | Flocks | Weeks 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 | 56-60 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (%) | | | | | | | | |
| A | Spring | 50 | 22.0 | 73.2 | 82.5 | 81.0 | 78.6 | 76.6 | 74.0 | 71.2 | 69.8 |
| | Fall | 51 | 26.9 | 76.8 | 83.0 | 81.5 | 79.5 | 77.5 | 74.3 | 70.3 | 71.2 |
| | Annual | 227 | 22.0 | 74.6 | 83.6 | 82.4 | 80.0 | 77.3 | 74.2 | 70.9 | 70.6 |
| B | Spring | 16 | 9.0 | 66.7 | 84.6 | 81.8 | 78.4 | 76.3 | 74.1 | 70.9 | 67.7 |
| | Fall | 20 | 14.9 | 75.3 | 84.6 | 83.3 | 79.7 | 76.5 | 73.5 | 67.8 | 69.5 |
| | Annual | 68 | 13.2 | 73.4 | 85.2 | 83.2 | 79.6 | 76.1 | 73.1 | 69.3 | 69.1 |
| C | Spring | 10 | 25.8 | 79.0 | 86.3 | 83.5 | 81.3 | 78.0 | 73.7 | 71.3 | 72.4 |
| | Fall | 15 | 29.1 | 83.0 | 87.5 | 85.4 | 83.7 | 80.8 | 76.8 | 71.8 | 74.8 |
| | Annual | 55 | 28.4 | 81.0 | 87.1 | 84.9 | 82.5 | 79.1 | 75.3 | 71.9 | 73.8 |
| D | Spring | 25 | 14.5 | 70.8 | 84.5 | 82.1 | 79.1 | 75.1 | 70.9 | 68.8 | 68.2 |
| | Fall | 15 | 13.8 | 67.1 | 83.0 | 82.9 | 79.8 | 77.4 | 73.3 | 70.2 | 68.4 |
| | Annual | 70 | 18.1 | 73.3 | 84.1 | 82.2 | 78.9 | 75.9 | 71.8 | 68.6 | 69.1 |
| E | Spring | 8 | 21.3 | 73.1 | 81.5 | 82.1 | 79.2 | 77.0 | 74.8 | 72.1 | 70.2 |
| | Fall | 7 | 24.7 | 75.4 | 80.7 | 80.9 | 79.3 | 77.5 | 74.9 | 70.8 | 70.5 |
| | Annual | 35 | 23.8 | 73.4 | 81.6 | 81.5 | 79.0 | 76.2 | 73.8 | 70.9 | 70.0 |
| All* | Spring | 125 | 18.6 | 71.9 | 83.4 | 81.5 | 78.8 | 76.1 | 73.1 | 70.4 | 69.2 |
| | Fall | 122 | 22.9 | 75.3 | 83.2 | 82.0 | 79.6 | 77.2 | 74.0 | 69.8 | 70.5 |
| | Annual | 504 | 20.9 | 74.4 | 83.8 | 82.3 | 79.5 | 76.6 | 73.4 | 70.2 | 70.1 |

* includes other strains.

## Discussion

Strains A, C, and D demonstrated a pattern of high, early mortality with low, late mortality in fall-hatched flocks when compared to spring hatches. Even though this reversal in pattern over the laying period tended to equalize total mortality, fall-hatched flocks still had a higher net mortality rate. This high, early mortality rate is a distinct disadvantage relative to hen-housed egg production. Identical hen-day production and mortality rates will not yield similar hen-housed egg numbers if the pattern of mortality is different to the extent observed in this study.

Strain B showed a very unique mortality pattern with no seasonal effects apparent. Strain E involved the fewest number of flocks (35) and demonstrated an early mortality peak for all seasons. Mortality rates near the end of the laying period were significantly lower in the spring-hatched flocks.

Strain B produced 5.4 more eggs in the fall-hatched flocks as a result almost exclusively related to a higher hen-day rate of lay. The Strain A fall-hatched flocks, on the other hand, had only a 1.6 egg advantage because of a 1.4% higher rate of production but also because of a high, early mortality pattern.

## Comments

Mortality comparisons between strains must include a consideration of when birds die. This has a definite impact upon the total number of eggs produced by a facility or by a given number of birds started. Seasonal problems associated with individual strains should be recognized and programs implemented to reduce their incidence.

Even though no causes of mortality were available in this study, it is readily apparent that strains do differ in their overall rate of mortality as well as in their pattern of mortality. In some strains, the pattern appears to be highly associated with season and early sexual maturity. We would presume, therefore, that the mortality was associated with prolapse and cannibalism.

A high proportion of the flocks in this study were raised in open-type housing where light programs are limited to either natural patterns or artifically supplemented step-down patterns. Fall- and winter-hatched flocks coming into production during period of increasing day lengths started to lay earlier (Table 5) and experienced dramatically higher mortality rates at the same time (Table 3).

This study demonstrates the need for better sexual maturity control in the fall-hatches of strains A, C, and D. This could be accomplished by more diligent application of the step-down program or by implementing a controlled feeding program aimed at holding flocks out of production until at least 20 weeks of age--if body weight is adequate.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