Neth. J. agric. Sci 19 (1971) 204—210

A production trial with layers of four hybrids under different environmental conditions in the Eastern Province of Saudi Arabia

H. Appelman and B. J. Bonhof [1]

International Land Development Consultants N.V., Arnhem, the Netherlands

Received: 17 May 1971

Summary

Commercial egg production is an important aspect in the Eastern Province of Saudi Arabia. At the Qatif Experimental Farm [2] near Dammam an experiment was conducted with layers of four different hybrids kept under controlled environmental conditions (air conditioning and ventilation) and under 'traditional' open housing conditions.

The controlled environmental conditions tended to promote better production characteristics but the differences, compared to open housing conditions were not of such a magnitude to warrant the costly cooling facilities needed.

Among the four hybrids tested an Australorp × (Rhode Island Red × New Hampshire) and a White Leghorn hybrid proved to be best adapted to the local open air conditions.

Date of trial and facilities

The trial was conducted between 16 April 1966 and 13 August 1967 at the Qatif Experimental Farm near Dammam in the Eastern Province of Saudi Arabia. The stock was flown in as one-day-old chicks from the Netherlands. The rearing period lasted till 21 August 1966, followed by the laying period till 13 August 1967. The complete feeds used during the trial were shipped also from the Netherlands.

The trial facilities consisted of 2 insulated units equipped with air conditioners and ventilators and 4 'open air' units under a single roof of corrugated galvanized sheets. All units measured 5.5 × 7 m inside, accommodating 125 layers each. The insulated units featured both slatted chicken floors and litter space. The hens in the open air units were kept on litter (wood shavings). The units were completely outfitted with automatic waterers, feed-hoppers, roll-away nests and roosts. During the first part of the raising period gas brooders were operated.

[1] On detachment with ILACO from the Central Institute for Poultry Research 'Het Spelderholt', Beekbergen, the Netherlands.

[2] Jointly financed by the Saudi Arabian Government and UN Special Fund through FAO. The farm was established and managed between 1964 and 1969 by the International Land Development Consultants N.V. (ILACO), Arnhem, the Netherlands.

Purpose of the trial

The trial was carried out in order to:
- study the productivity of layers under controlled climatic environments compared to the productivity under the prevailing conditions in open air poultry houses;
- test the adaptability of four hybrids to the local conditions under management in open housing.

Hybrids used in the trial

The following hybrids, originating from the Co-operative Poultry Breeders Institute (CPI) in the Netherlands, were selected for testing:
- CPI Black: Australorp × (Rhode Island Red × New Hampshire); black feathered hen, brown egg
- CPI Star: Single Combed White leghorn hybrid; white feathered hen, white egg
- CPI Selecta: Rhode Island Red × S.C. White Leghorn; white coloured hen with brownish neck feathers, whitish egg
- CPI Red: Rhode Island Red × (New Hampshire × Rhode Island Red); dark reddish brown coloured hen, brown egg.

Design of the trial

a. Controlled environmental conditions: 2 groups, initially 161 Black and 166 Star one-day-old chicks, in the insulated poultry house.
b. Open housing: 4 groups, initially 161 Black, 166 Star, 154 Selecta and 148 Red one-day-old chicks.

Feeds

The following feeds were supplied ad libitum:
0–6 weeks: starter pellets I (crude protein 20.5 %, productive energy 1920 kcal/kg)
7–13 weeks: starter pellets II (crude protein 18.0 %, productive energy 1970 kcal/kg)
14 weeks-laying: grower pellets (crude protein 15.0 %, productive energy 1905 kcal/kg)
from laying onwards: layer pellets (crude protein 17.0 %, productive energy 2000 kcal/kg)

The starter and grower pellets contained a coccidiostat. Grit and crushed oyster shell were supplied ad libitum. From 3 weeks onwards fresh lucerne was fed: 3 g per chick per day during the rearing period and 6 g per hen per day during the laying period.

Due to long sea carriage and improper storage in the harbour the quality of the feed received from the respective shipments differed widely. Particularly during the last 6 months of the laying period low-quality pellets had to be fed. In view of the inevitable losses of vitamins in the stored feed additional vitamins (AD_3) were supplied in the feed hoppers.

Vaccination schedule

The following vaccination schedule was adhered to:
at 4 weeks: combined vaccination against New Castle disease (Strain Hitchner Bl, water-soluble) and infectious bronchitis (water-soluble);

at 10 weeks: revaccination against infectious bronchitis (water-soluble);
at 4 months: vaccination against fowl pox (feather follicle method);
at 5 months: revaccination against New Castle disease (Strain La Sota, water-soluble).
The combined NCD/IB vaccin was purchased locally, the other vaccins were flown in.

Illumination schedule

During the first month of the rearing period illumination was extended to a 24-hour day. In the second month the duration of light was gradually reduced to 14 hours per day and this schedule was maintained throughout the trial period.

Ventilators and air conditioning

The wall ventilators in the insulated units were operated from the 6th week of the rearing period whenever deemed needed. From 19 September till 24 November 1966 air conditioning was practised, maintaining a temperature of 23° C. Full time air conditioning was resumed on 29 April 1967 and maintained until the end of the trial.

Results of the trial

The chick rearing period 16-4-'66—21-8-'66). The results of the rearing period are presented in Tables 1 and 2. According to expectations the highest pullet weight was

Table 1. Average cumulative feed consumption, liveweight and cumulative feed conversion per pullet (126 days).

Group (treatment)	Cumulative feed consumption (g)	Liveweight on 21-8-'66 (g)	Feed conversion [1]
Black (insulated)	6,280	1,602	4.019
Black (open)	6,203	1,578	4.032
Star (insulated)	5,338	1,227	4.487
Star (open)	5,348	1,234	4.469
Selecta (open)	5,763	1,397	4.250
Red (open)	6,245	1,539	4.174

[1] Feed intake in kg required for 1 kg of growth.

Table 2. Mortality and culls per hybrid group (numbers).

Causes of losses	Black	Star	Selecta	Red	Total
Undigested yolk	3	1	—	1	5
Diarrhoea	2	—	1	—	3
Navel ill	2	—	—	1	3
Abnormalities of internal organs	—	2	3	2	7
Cannibalism	—	—	2	4	6
Accidents	1	3	—	2	6
No indications	—	1	2	3	6
Total numbers	8	7	8	13	36
Percentage	2.5	2.1	5.2	8.8	3.8

gained by the Black and the Red. It seemed that the most favourable feed conversion was found with the Black, followed, in that order, by the Red, Selecta and Star. The influence of the partly controlled environmental conditions (ventilators only) does not seem conclusive.

The losses per hybrid group are given in Table 2. The overall mortality rate during the hot season rearing period can be considered extremely low, particularly in the Star and Black.

The laying period (22-8-'66—13-8-'67). At the start of the laying period the number of started hens was reduced to 124–126 per group. The results of the laying period are summarized in Tables 3–9.

Feed consumption

The data of Table 3 indicate that the overall feed intake was rather low in all groups. The feed consumption of the hens kept under controlled environmental (cooler) conditions in the insulated house was higher than under open air conditions.

Table 3. Summary of feed consumption.

Group (treatment)	Average feed consumption per hen per day (g)	Total feed consumption per hen during 357 days (kg)
Black (insulated)	117.3	41.9
Black (open)	107.3	38.3
Star (insulated)	112.1	40.0
Star (open)	97.0	34.6
Selecta (open)	101.9	36.4
Red (open)	102.2	36.5

Egg production

The age at the onset of laying was normal in all groups (Table 4). The productivity of all groups was decidedly low. Considering the egg production per hen housed and

Table 4. Laying percentages and egg production by numbers.

Group (treatment)	Date at 10 % lay	Overall average laying percentage	Production of eggs	
			per hen housed	per hen laying
Black (insulated)	18-9	56.6	190	202
Black (open)	16-9	52.5	173	188
Star (insulated)	17-9	56.4	186	201
Star (open)	18-9	53.4	165	191
Selecta (open)	15-9	55.0	165	196
Red (open)	27-9	37.5	111	134

per hen present it can be stated that:
- there was not much difference in the productivity between Black and Star, be it that losses were less in the Black (see Table 7);
- the productivity of the Selecta was relatively good, but the hybrid suffered from high mortality and losses (see Table 7);
- the performance of the Red was extremely poor;
- the controlled environmental conditions seemed to exercise a favourable influence on the egg production.

The egg weights (Table 5) were low in all groups, as 60 g should be considered normal for the hybrids in question. The eggs produced under controlled environmental conditions tended to be heavier than those produced under open air conditions.

The feed conversion in all groups except the Red can not be considered unfavourable.

Table 5. Egg production by weight and feed conversion.

Group (treatment)	Overall average egg weight (g)	Total weight of eggs produced (kg)	Cumulative feed conversion [1]
Black (insulated)	56.3	1,335	3.680
Black (open)	55.0	1,191	3.714
Star (insulated)	56.3	1,323	3.529
Star (open)	55.8	1,151	3.252
Selecta (open)	55.0	1,126	3.374
Red (open)	57.5	796	4.735

[1] Feed intake in kg to produce 1 kg of eggs.

Liveweights

The final liveweights (Table 6) of the Black, Star and Selecta in the open housing were rather low, considering the hybrids in question. The data indicate that the Black were the heaviest birds and that the controlled environmental conditions tended to promote higher liveweights.

Table 6. Average liveweights (g).

Group (treatment)	At start of laying period 22-8-'66	After 30 weeks of production 15-3-'67	At termination of trial 13-8-'67
Black (insulated)	1,624	2,741	2,894
Black (open)	1,605	2,643	2,665
Star (insulated)	1,252	1,968	2,040
Star (open)	1,252	1,890	1,874
Selecta (open)	1,414	2,181	2,132
Red (open)	1,548	2,546	2,517

Table 7. Mortality and culls (numbers).

Causes of losses	Black (ins.)	Black (open)	Star (ins.)	Star (open)	Selecta (open)	Red (open)	Total	Percentage
Heat stroke	—	29	—	30	39	35	133	52.2
Cannibalism	3	3	5	8	11	6	36	14.1
Coccidiosis	1	1	1	7	1	3	14	5.5
Abnormalities of internal organs	5	3	—	3	5	8	24	9.4
Egg boundness	2	2	3	4	2	6	19	7.5
Accidents	2	1	3	1	2	1	10	3.9
No indications	3	3	2	1	6	4	19	7.5
Total numbers	16	42	14	54	66	63	255	
Percentage	12.8	33.6	11.1	43.5	52.8	50.4	34.0	

Losses

The losses under controlled environmental conditions proved normal (Table 7). The high overall mortality was mainly (over 50%) caused by high temperatures coinciding with a sudden rise in relative humidity on 30 May, 4 June and 24 July 1967 as illustrated in Table 8.

Table 8. Mortality, temperatures and humidities in the open houses.

Date	Number of dead birds	Time	Temperature (°C)	Relative humidity (%)
30 May	25	15.00	44.0	nil
30 May		18.00	42.0	50
4 June	25	15.00	44.0	6
4 June		15.30	40.0	59
24 July	83	14.00	43.5	37
24 July		14.30	40.0	63

Power consumption

There was, of course, a great difference between the power consumption of the insulated, air-conditioned and ventilated units and the open air units. This is illustrated in Table 9.

It should be borne in mind that the trials were conducted in small units requiring relatively large A.C. equipment. However, the figures indicate that air-conditioning in general can not be considered to be a paying proposition unless power costs are extremely low.

Table 9. Power consumption per experimental unit (kWh).

	Insulated unit [1]	Open housing unit
Rearing period		
Ventilator	175	—
Illumination	170	58
Subtotal	345	58
Laying period		
Air conditioner	10,050	—
Ventilator	205	—
Illumination	400	129
Subtotal	10,655	129
Grand total	11,000	187

[1] A.C. units operated during 117 days maintaining a temperature of 23°C.

Tentative conclusions

The trial indicates that:

- one-day-old chicks as used and managed in the trial can be succesfully raised under climatic conditions as prevailed during the summer 1966 in the Qatif Area of Saudi Arabia;
- keeping layers under controlled environmental conditions, as practised in the insulated poultry house, compared to open air housing resulted in: higher egg production, better egg weights, higher feed consumption, more favourable feed conversion, higher liveweights, lower mortality and no losses caused by heat stress;
- the better performance, however, was not of such a magnitude that investments and operating costs required to maintain such conditions could be considered economically justified under 'normal' climatic conditions in the Qatif Area;
- the CPI Black (Australorp × (Rhode Island Red × New Hampshire)) tended to be the best adapted hybrid under open air conditions. However the feed conversion was better in the CPI Star (White Leghorn hybrid);
- the CPI Selecta (Rhode Island Red × White Leghorn) proved to be the most productive hybrid, but suffered from higher mortality;
- serious mortality resulted from temperatures of 40° C and over, coinciding with sudden increases of the relative humidity.