Egg Production Complexes

Location, transport logistics, availability of land and labour, planning restrictions and environmental issues must all be taken into account in the planning process.

In a 1991 US survey, it was determined that there were approximately 156 in-line egg production complexes in the United States representing 47% of the nation's layer flock. It was also concluded that this number would increase to 220 with 67% of the nation's flock by the turn of the century - an increase of almost 80 million birds in nine years. Sixty of these would be in complexes with one million or more hens each.

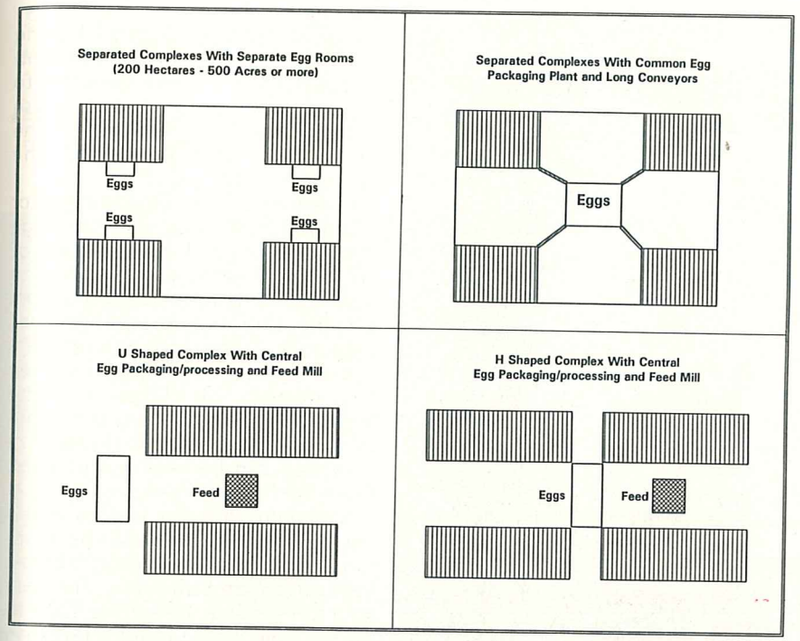
How do we define the term 'in-line egg production complex'? The application of this concept is much older than the terminology even though the name has been around for more than 20 years. I think Webster has the best definition, something 'having many varied inter-related parts'. Farms with multiple houses, an egg processing room and even a feed mill have always been around, we just used to call them 'farms'. We began to call them complexes in the 70's when we added the concept of belt delivery of eggs to an egg room - the 'in-line' or 'on-line' part of the phrase.

Today, the in-line egg production complex is the 'norm' for the US industry. Practically no new farms are being built that would not fit this definition. The extent of its replacement of older non-complex farms appears to meet the predictions of the 1991 survey.

For simplicity sake, the in-line complex under discussion will be defined as having two or more houses with different flock ages and a conveyor system linking the production houses with the egg room. For this discussion we will not limit size because of the needs of various regions. The principles can be applied to different circumstances. In the US, this complex would normally consist of 8 to 12 houses with a total capacity of 500 000 to 1 500 000 hens.

Determining a replacement policy

House size and number, farm size, the number of rearing facilities and marketing all require a carefully thought-out replacement policy. How long will flocks be kept before sold or recycled? This question must be determined relative to maximising returns from the investment associated with the complex. Typical two-cycle programmes in the US, for example, can be supported by one rearing unit for each five laying units. In countries that use the one cycle system, one rearing unit would be required for each three laying units. Such relationships dictate the number of laying units - in the US in increments of five; in other countries, increments of three. Both of these are contingent upon the age when pullets are moved and the vacant time allowed between flocks.



What is needed to determine the optimum size of the complex or houses?

Today, we see houses being built with capacities in excess of 100 000 and 200 000 hens. Individual sites (farms) may have one to two million hens or more. Obviously, this can only apply in countries with similar populations and market demand to the US. Even one such house would disrupt the fragile balance of supply and demand in many smaller countries. In addition, the economic advantages for this type of operation may not even exist.

The answer to how big a house or farm should be is one that changes constantly. We can obviously engineer enormous houses that will satisfy the needs of the flock but without a sufficient high quality source of replacement pullets to fill it, our house is too big to match our other restrictions. What should dictate the size of house should be the availability of enough uniform replacement pullets to allow the success of our management programmes. A wide spread in ages or sources of replacement stock will only invite trouble for the manager.

The most importance influence on complex size today is the capacity of the egg packaging equipment. As these units increase in capacity, we will see our farm sizes also increase. Today, the packaging (wash, candle, size and carton) equipment can handle in excess of 90 000 eggs/hour. Because of the high cost of such equipment, egg producers have chosen to operate this equipment at full capacity in order to keep their costs down. An eight hour (seven days/week) operation therefore dictates a farm size of approximately one million hens. Because of the nature of our replacement programmes (recycled with sale at 105 weeks), this commonly equates to ten 100 000 hen houses.

Large houses sufficient to house this many hens, are commonly 20 by 200 metres (60 by 600 ft) in size. This places severe constrains on many of our equipment systems in particular, certain types of feeders and ventilation systems. As stated earlier, we must be able to deliver uniform conditions to the entire flock if we are to have a successful management programme. Failure to do this, will lead to sub-optimum performance and higher costs.

Higher capacity egg packaging equipment (or breaking equipment) in the future should be used to process more product, but house capacity must be limited to the availability and needs of the individual flock.

The physical land requirements for a complex will vary with the cage configuration and the amount of buffer land (set-back) planned to separate the poultry operation from neighbouring properties. In general, we would prefer to see at least a 100 metres (300 ft) buffer zone between any poultry buildings and the property line surrounding the farm - the more the better. If the poultry operation can be kept out of sight, this would also be preferred.

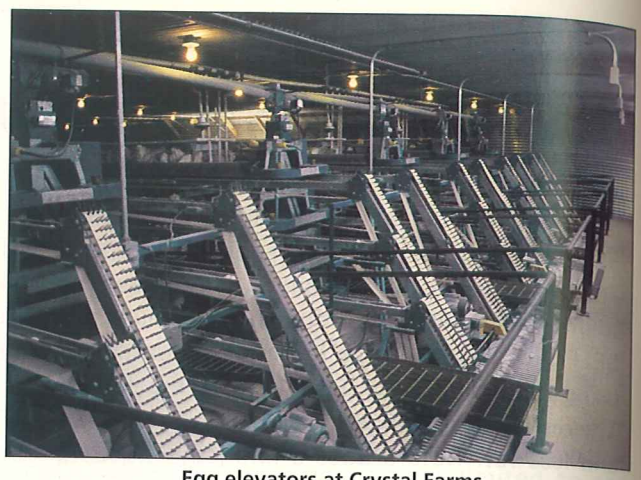
Assuming four-tier houses and a one million hen complex, the space requirement for buildings, suitable separation of buildings, ancillary structures and a 100 metre (300 ft) buffer zone would require less than 20 hectare (50 acres). A complex based upon greater flock separation would obviously require greater space allocations. Two one hectare parcels would be required for the two pullet rearing farms.

What are the basic components of tomorrow's in-line complex?

The essential elements of a complex are multiple layer houses and an egg room (cartoning and/or breaking). Some producers today have also incorporated pullet rearing facilities into their complex but we prefer these to be on a separate site for disease security purposes. Others have built on-site feed milling with auger delivery of feed to each laying house to reduce handling costs. Some have installed new technologies to process their farm wastes into a valuable by-product.

With an increasing market for processed eggs (liquid, dehydrated or frozen eggs), several farms have installed in-line delivery of eggs directly from the egg production

Layer complex Cal Maine Foods.



Egg elevators at Crystal Farms.

houses and/or the cartoning facility to the breaking room. Some farms are now processing 100% of their production in this form.

Many in-line operations have added an 'off-line' component to their egg packaging room so that more flexibility can be gained and the hours of operation can be increased. This, of course, requires strict security policies to assure that in-coming product is properly handled to avoid contamination of the resident laying flock.

Are there other configurations possible?

The concentration of birds for efficiency does not come without risk. The traditional complex design with eight or more age groups in close proximity with each other requires extreme care to avoid the transfer of disease problems from one flock to another and to maintain a relatively low level of health problems on the site. Depopulation (except by single building) never occurs and carry-over of micro-organisms in the house and resident animal and insect populations is always a potential source of problems.

Flock security is a difficult enough problem with separate sites because of inter-farm visiting and exchange of equipment; the closely knot complex security problems become almost unmanageable. Depopulation of an age group commonly leaves a few residual hens free to stroll over the farm at will. Feathers and dust are often free to exhaust from one house and to enter the intakes of another. Manure clean out often results in a mass exodus of rodents from one house to another more comfortable site in the house next door.

Community, state and federal restrictions play an important role in deciding whether or not a new egg production complex will be allowed.

Complexes have been built with only one or two age groups in order to lessen the disease risk. Such farms are usually less than 500 000 hens in size and must be part of a larger organisation because of the poor egg size distribution. Smaller capacity egg packaging equipment is used and labour efficiency suffers little from the smaller size.

Other complexes have been built with considerable distance allowed between age groups to reduce the possibility of disease exposure. This type of in-line complex must rely on lengthy conveyor systems to accommodate the longer distances between units. Even though flocks are separated by greater distances, they must be managed to maintain their relative isolation.

Even though, this discussion addresses the in-line complex, we must mention the possible alternative of separated (300 metres or more) (900 ft) age group sites. Such sites can be linked to the egg room with conveyors, but an efficient transportation system to a central plant may also prove to be cost effective - especially in light of minimising the disease risk.

What type of equipment should be considered?

Equipment requirements used to be concerned with questions of optimum cage density, uniformity of feed delivery, water systems that didn't leak and egg gathering systems that didn't break eggs.Today, we can add manure handling which will produce a trouble-free waste product (of value), a ventilation system that assures high quality air of optimum temperature and low toxic gas level uniformly to every bird, and equipment controls that will integrate our mechanical devices with our pre-established guidelines for flock comfort, efficient use of feed and optimum egg flow into the packaging room.

Houses should be designed to provide uniform temperatures in the 20 to 30 degrees C (68 to 86 degrees F) range with good air quality. Both extremes should be available regardless of the season in order to accommodate the production efficiency requirements of flocks of differing ages. This, of course, will require ventilation systems capable of low volume delivery as well as supplemental cooling.

The density question is still controversial, but in many parts of the world, regulations dictate floor space, colony size, feeder space and floor slope allowances. Such regulations tend to standardise the systems available. In the US, considerable variation still exists in this subject area. In general, regulations required 450 cm sq or more of floor space/hen and 10 cm of feeder space. In the US, common practice allows 300 to 350 cm sq/hen with about 7.5 cm of feeder space. It must be pointed out, though, that

the US space figures represent White Leghorns and the European requirements are for both white and brown egg breeds. The brown hens weigh 30 to 35% more than typical white egg hens in the US.

Cage configuration in the US has gone through major changes in the last decade. This has been a direct result of more aggressive marketing from European manufacturers. Tiered systems with four or more levels are now the most common. Today, the traditional European stacked system (with belts) has become popular in the US where it was practically non-existent before.

Alternatively, many producers prefer the high-rise manure holding system which they feel offers greater flexibility in their waste handling programme. Regardless of the system, both place considerable emphasis on reducing waste-associated problems and enhancing the value of this by-product.

How much labour will be required?

The principle driving force behind the in-line complex trend is to reduce labour costs. Most of this is associated with the mechanical handling of eggs into the final package (carton). Today's complexes are able to reduce house caretaking and egg packaging requirements to as few as 15 persons/million hens. With the addition of pullet rearing, feed mixing and management, a one million hen complex should be able to operate with 25 to 30 people.

House caretakers (10 houses)	5
Egg packaging (cartoning)	10
Management and bookkeeping	2
Pullet rearing	6
Feed milling	2
Repair and maintenance	1

Practically all of these jobs require 7 day/week coverage and therefore, the total number of people (including back-ups) would be greater than 25 to 30.

A 25 to 30 person work force (per 8 hour day) at $7.50/hour would cost the operation between $550 000 and $650 000/year. With an annual production of 21 million dozen eggs, labour cost would be between 2.6 and 3.2 cents/dozen.

How much will the total investment be?

Housing and equipment costs will vary between countries and the type of facility. In addition, when expressed on a 'per bird' basis, costs are less meaningful. The costs listed are estimates of what we feel a typical complex in the US might represent.

	$/Hen
Land (40 hectare) (100 acres)	0.25
Site development (grading, water, roads, fences, power, etc)	0.50
Layer housing and equipment	8.00
Pullet buildings and equipment	1.25
Egg packaging building (with offices) and equipment	1.00
Feed mill and delivery system	1.00
On-site manager residence and night caretaker quarters	0.10
Total:	12.10

Where should you build your complex?

In general, we would say "don't build it at all if you're not replacing older out-dated facilities". In the US, the addition of complexes to our industry appears to be getting ahead of the closing down of older facilities and the increase in demand for eggs. A new one million hen complex represents about a 0.5% increase in the nation's flock size. This may not seem much, but one million excess hens is associated with about a $40 to $50 million loss in the industry's egg income. Obviously, 750 000 eggs/day must find a home!

If a new complex is part of a well-planned programme to replace existing units, its location become a simple economic question of the cost of transporting feedstuffs to the site plus the cost of transporting the finished products to the market versus those same costs for other locations. Unfortunately, the local welcome of your new farm, relative availability of land, environmental constrains and sources of labour must also be considered.

Today, community, state and federal restrictions play an important role in deciding whether or not a new egg production complex will be allowed or with what restrictions. Environmental issues are placing enormous constraints on the establishment of any new facility. It is obvious that because of the size of these units, local government must be convinced that the environment will not suffer when they come to the community. This, of course, requires not only the best planning possible, but also the use of the best technology available. — *Dr Donald Bell, Cooperative Extension, University of California.*