SUMMARY AND CONCLUSION

The data indicated that no statistical difference was found between the effect of dietary energy levels of 2650 and 2850 kcal on egg production when averaged over all levels of protein under both systems of housing. But with a further increase of the energy level up to 3050 kcal per kg diet, egg production tended to decreases ($P < 0.05$). The rate of egg production of the laying hens fed diets containing 18 percent protein was significantly higher ($P < 0.01$) than the rate of those fed diets containing 15 percent protein. Fifteen percent dietary protein appeared to be deficient for good egg production in this study. Under the litter system, the hens laid eggs at a higher rate ($P < 0.05$) than those under the cage system. This might be due to the fact that some of the birds in individual cages suffered from cage fatigue. Also under the floor litter system, there was an advantage as the birds could pick up some products of intestinal synthesizes from lit-
ter (Card, 1962) which stimulated better egg production especially of laying hens fed diets containing 15 percent protein.

Increasing the dietary energy levels from 2650 kcal to 3050 kcal per kg diet resulted in a highly significant ($P < 0.01$) decrease of feed consumption per bird per day in a linear trend. Feed consumption of laying hens fed the dietary protein level of 18 percent either under the floor litter system or under the cage system was higher ($P < 0.01$) than that of laying hens fed diets containing 15 percent protein. This higher feed consumption may be due to higher rate of egg production of birds fed the dietary protein level of 18 percent.

There was no statistical difference between the water consumption per bird per day of the birds fed 18 or 15 percent of dietary protein averaged over all levels of energy under the floor litter system. However, under the individual cage system at all levels of dietary energy, the laying hens fed dietary protein at 18 percent consumed more water ($P < 0.01$) than those fed the dietary protein at 15 percent.

Feed conversion was significantly influenced by the level of protein in the diet. Feed conversion of laying hens fed dietary protein at 15 percent either
under the floor litter system or under the cage system was poorer ($P < 0.01$) than that of the laying hens fed the dietary protein level of 18 percent at all levels of energy. The lower feed efficiency among the former group of birds was due to the lower rate of egg production obtained from this group. Feed conversion of laying hens fed diets containing 18 percent protein under both systems of housing improved ($P < 0.05$) in curvature trend as the dietary energy increased from 2650 kcal to 3050 kcal. The dietary energy level of 2850 kcal and 18 percent crude protein is the most efficient combination in regard to feed conversion. The data also clearly indicate that feed conversion of laying hens under the individual system was significantly poorer ($P < 0.01$) than feed conversion of laying hens under the floor litter system. This lower feed efficiency among the birds under individual cage system is due to the fact that rate of egg production of laying hens under the cage system is lower ($P < 0.05$) than that under the floor litter system. Another reason is that under the floor system the birds may pick up some products of microbial synthesis which may stimulate better feed efficiency (Cará, 1962).

The egg weight of laying hens fed the dietary energy level 2650 kcal of metabolizable energy under
the individual cage system was greater (P < 0.05) than that of laying hens under the floor litter system. No significant differences were found in egg weight among the laying hens fed dietary levels of 2850 and 3050 kcal when averaged over all levels of protein either under the floor litter system or under the cage system. However, the difference is significant in favor of the dietary energy level 2650 kcal of metabolizable energy for the floor litter system. Under the floor litter system the egg weight of laying hens fed 18 percent protein and 2650 kcal of metabolizable energy is heavier (P < 0.05) than that on a diet containing 15 percent protein and the same dietary energy level. The difference between the egg weight of the birds fed diets containing 18 percent and 15 percent protein at the same dietary energy level (2650 kcal) under the floor system was probably due to different caloric intake.

Under the floor litter system, the Haugh units of the laying hens fed diets containing 15 percent protein were higher (P < 0.05) than that of the laying hens fed the diet containing 18 percent protein. The data also indicated that the Haugh units of eggs of the laying hens fed diets containing 15 percent protein, under the cage system, were significantly higher (P < 0.01) than that of laying hens fed dietary protein at 18 percent. There was a significant interaction between pro-
tein and energy level on Haugh units (P < 0.05). At the dietary energy level 2650 kcal of metabolizable energy, the Haugh units of eggs of the laying hens fed dietary protein at 15 percent were significantly higher (P < 0.05) than those of eggs of the laying hens fed the dietary protein level of 18 percent. There was also a highly significant difference between the Haugh units of eggs of laying hens fed dietary protein levels of 18 and 15 percent with an energy level of 2850 kcal per kg diet. The Haugh units decreased (P < 0.01) with increase of dietary protein from 15 to 18 percent. The difference of egg quality measured by Haugh units that exists among the laying hens fed diets containing 15 percent and 18 percent at both levels of dietary energy 2650 kcal and 2850 kcal per kg diet, was related to the difference in rate of egg production of hens fed the two different diets.

The shell thickness excluding shell membrane of the laying hens under the floor litter and cage systems decreased significantly (P < 0.01) with the increase of the dietary protein level from 15 to 18 percent. There is a highly significant interaction between energy and protein levels on shell thickness; the shell thicknesses among the laying hens fed diets containing 2650 kcal of metabolizable energy per kg diet being decreased
(P < 0.01) when protein level was increased from 15 to 18 percent. The shell thickness of eggs of the laying hens fed a dietary energy level of 2850 kcal was also reduced (P < 0.05) as the protein level in the diets increased from 15 to 18 percent. The difference among shell thicknesses of laying hens fed diets containing 15 percent and 18 percent protein in this study was probably due to the difference of egg production rate.

The data show no significant difference of mortality among the laying hens fed dietary energy levels of 2650, 2850, and 3050 kcal under both systems of housing. The rate of mortality of the laying hens fed the dietary protein level of 15 percent, under the floor litter system, was significantly higher (P < 0.01) than that at the dietary protein level of 18 percent. This is due to the fact that the laying hens fed the dietary protein level 15 percent tended to be more susceptible to prolapse of oviduct which was followed by pick-outs. However, there was no significant difference in mortality among birds fed diets containing 15 and 18 percent protein under the individual cage system. Under cage system cannibalism and pick-out habits can be prevented (Winter and Funk, 1956).

From the standpoint of the income over feed cost per hen per year it was found that the dietary protein
of 18 percent at all levels of dietary energy employed
either on the hen-day basis or hen-housed basis under
both systems of housing was more profitable than the
dietary protein level of 15 percent.

The combination of the dietary energy level of
2850 kcal and 18 percent protein gave the highest return
of rupiahs, with the existing prices of feed ingredients.
However, at different times and different regions the
price of corn (the main source of energy) may vary wide-
ly, so that the economic superiority of the intermediate
energy level might be changed. The low energy level
(under both systems of housing) and the highest energy
level (under the floor system) both also gave good pro-
duction. So from the stand point of feeding for maximum
profit, it is necessary to adjust the energy level in
the rations according to the cost of energy ingredients
available.