V. SUMMARY AND CONCLUSION

A comprehensive study was conducted to assess the possibility of using enzyme complexes for enhancing the nutritive value of agro-industrial by-products in laying hen diets. Different feedstuffs regularly used in laying hen diets were analyzed for their NSP contents. Using them, a laying hen diet with the most commonly followed formulation pattern was created and fed to commercial layers with and without supplementation of a logically matching enzyme mix. The performance and health parameters were observed over a duration of 24 weeks and the results were compared. In addition, a simple survey covering the common error factors in enzyme application to layer diets was conducted at different geographical pockets of poultry production in south India, to assess the farmer approach and attitude towards enzymes for poultry diets and to make necessary recommendation on the need basis.

The results of the laboratory analysis of feed ingredients showed that the NSP content of by-products like DORB, SFE, GNE and SBM were high while that of the cereals were, relatively, low. In the cereals, the total pentosan content (2.75-5.36%) was by far the highest in proportion to pectins(1.01-1.80%) and cellulose (3.06-3.15%) components, while in oilcakes such as SBM and GNE, pectins were in higher proportions (4.95 and 11.7%) than pentosans (4.18 and 6.12%) and cellulose(5.76 and 6.57%). SFE and DORB had cellulose as the major NSP component(23.67 and 15.39%) as compared to pentosans(11.16 and 10.73%) and pectins (4.95 and 7.20%). In summary, cereals were high in total pentosans alone with minor proportions of cellulose and pectins, while the oilcakes and DORB were high in both pectins and cellulose with significant content of pentosans too.

The studies indicated that pentosans, pectins and cellulose were the major NSP components among the common poultry feedstuffs and any enzyme preparation targeted at diets formulated with them should mainly include xylanase, pectinase and cellulase. A commercial enzyme preparation with such enzyme composition was procured for trial in commercial layer diets under field conditions. The enzyme preparation had enzyme activities of xylanase (1899 IU/g), pectinase (482 IU/g) and cellulase (452 IU/g) at the onset of the trial and was found to be quite stable at room temperature for more than six...
months as was revealed by the analysis at the closure of the trial with activities in the same range as at the onset.

The biological field trial was conducted in a commercial layer farm on 13176 Bovans White commercial layers, with and without enzyme supplementation at 0.5 kilogram per ton feed to a common basal diet, over a period of 6 periods of 28 days each, covering 24 weeks in all. The trial proved that enzyme supplementation essentially improved the nutritive value of the feed (and in turn, the feedstuffs used). Enzyme supplementation reduced the feed intake by an average of 4 grams per bird per day and improved the feed efficiency by about 5 grams per egg over the entire duration of the trial, both suggesting better nutrient utilization upon enzyme supplementation. Enzyme supplementation also had minor but positive influence on egg production (+ 0.4%). The influence on egg weight and livability were negligible.

Enzyme supplementation also reduced gut viscosity and litter moisture by 14.3 and 9.7 per cent, as compared to their respective controls. This also helped in improving the nutrient digestibility as represented by an improvement in the ileal digestibility of protein by 12.5% as compared to control in enzyme supplemented group. Enzyme supplementation also considerably reduced the total bacterial counts and coliform counts in the intestines of supplemented birds. The reduction in digesta viscosity and the gut bacterial counts could have enabled the better digestion, absorption and utilization of nutrients leading to better gut health and improved performance.

The results of the current trial were clearly in favour of enzyme application to laying hen diets. However, the enzymes have so far not received a warm response they deserve by the farming community. The farmers do complain of inconsistent or lacking performance by the enzymes. While varying composition of different enzyme brands may be playing a considerable role in the on-farm results, the current study did not attempt to compare different brands available in the market, leaving the matter to the producers and consumers of enzyme preparations to decide upon. Alternatively, a survey was conducted aiming at the on-farm practices which may interfere with the observed efficacy of an enzyme preparation.
The data from the survey revealed that, ignorance about the right mode of application and targeting corresponding observations, non-weighing of feed ingredients prior to milling, and non-weighing of finished feed before bagging, were some of the main reasons responsible for the ‘apparent inconsistency in results’ of a given enzyme preparation over a period of time in the same farm and on the same birds.

Despite such drawbacks, about 52.6 per cent of the farmers have claimed good benefits and 21.1 per cent farmers have reported low to moderate benefits. This amounts to a 73.7 per cent farming community in support of enzymes, who have realized that enzymes can be truly beneficial. These findings along with the other findings of the survey have indicated that, with proper standardization of enzyme products and enzyme application, and with proper farmer education, might be able to provide much better results for those already using enzymes and convince the other farmers to follow enzyme application.

Based on the above in vitro studies, field trial and survey findings, it can be concluded that

- Cereals (maize, jowar and ragi) and their by-products (DORB) are found to be high in pentosan contents and oilcakes (SFE, GNE, SBM) are high in pectins and cellulose.
- Enzyme preparations containing xylanase, pectinase and cellulase would be appropriate for application in laying hen diets in Indian context.
- Commercial enzyme preparation with xylanase, pectinase and cellulase as tested in the study was considerably stable with good shelf life.
- Enzymes in layers may help improve the productive performance and health status of the birds as evidenced by improvement in feed efficiency and egg production with concurrent reduction in feed intake, gut viscosity, litter moisture and gut bacterial load.
- Based on the survey, it is understood that many factors pertaining to enzyme application have not been well understood by the farming community and therefore, it is recommended to establish practical standards for enzyme products and application procedures, and to conduct farmer education programmes, to popularize enzyme application in layer diets for better economical, bird health and environmental prospects.