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E-conference of the International Network for Family Poultry Development in collaboration with FAO and supported by the International Fund for Agricultural Development (IFAD)

Family Poultry interactions with other production systems
(forestry, tree crops, annual crops, large animals, fisheries, etc):
Nutritional opportunities and constraints

Summary and Conclusions

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Contents

1. Executive summary	2
2. Introduction	5
3. Summary of the conference topics	6
3.1 Climate change and the future availability of the scavengeable feed resource base (SFRB) for Family Poultry	6
3.2 Recent development in assessing feed resources for Family Poultry production including the scavengeable feed resource base.	7
3.3 Nutritional opportunities and constraints of integrating Family Poultry with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc).....	7
3.4. Opportunities and constraints of using commercial feed for Family Poultry	8
3.5. Developing and promoting improved Family Poultry feeding systems.....	12
4. Conclusions and recommendations	14
5. Acknowledgements	15
6. List of participants that contributed to the discussions	16

1. Executive summary

As part of the IFAD funded project "Smallholder Poultry Development Program" a second e-conference was held between 16 January and 17 February 2012 with the theme **"Family Poultry interactions with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc): Nutritional opportunities and constraints"**. This was organized by the International Network for Family Poultry Development (INFPD) and the Food and Agriculture Organization of the United Nations (FAO). The following aspects of Family Poultry production were discussed during the conference:

1. Climate change and the future availability of the scavengeable feed resource base (SFRB) for Family Poultry.
2. Recent development in assessing feed resources for Family Poultry production including the scavengeable feed resource base (SFRB).
3. Nutritional opportunities and constraints of integrating Family Poultry with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc).
4. Opportunities and constraints of using commercial feed for Family Poultry.
5. Developing and promoting improved Family Poultry feeding systems.

A background document was prepared and distributed to the registered participants in order to facilitate the discussion. A total of 210 participants registered for the conference, some of them after the discussions had started. Efforts were made to discuss the different topics separately but all were open for discussion throughout the conference time. Forty seven messages and four short papers were received from 20 countries which were distributed to the participants along with French version during the conference time. However, edited versions of all messages and papers were also transmitted to the participants at the end of the conference. In addition to the specific topics that were addressed in the conference, some general comments of the participants in relation to Family Poultry production system and their nutritional aspects were also considered important and therefore included in the document. The conference was jointly moderated by Professor Dr. S. D. Chowdhury, Department of Poultry Science of Bangladesh Agricultural University, Mymensingh, Bangladesh and Dr. D. Luseba, Department of Animal Sciences, Tshwane University of Technology, Pretoria 0001, South Africa being assisted by Dr. Olaf Thieme, Animal Production and Health Division, FAO, Rome, Italy. This document is a synthesis report of the conference.

Although being an issue of global importance and affecting Family Poultry production few participants responded to the sub-topic about climate change and the future availability of the scavengeable feed resources (SFRB) While the participants generally agreed that the impact of climate change is quite visible there is a paucity of information in this regard and viable data in relation to the impact of climate change on availability of SFRB are still to be generated. This should be a continuous process in order to better judge how FP production systems cope under changing situations. The impact of climate change should better be addressed by identifying new feed resources and using different feeding techniques.

The participants found that assessing feed resources including the scavengeable feed resource base is an important topic for Family Poultry production. It was suggested that the old methods of such assessment need to be improved by using birds' performance in order to make it more accurate. Seasonal factors/influence should also be taken into account. Recommendations from a recent seminar held in Bangladesh provide information for a

better assessment of the locally available/produced feed resources with an emphasis of indigenous poultry production based mostly on indigenous resources.

Concerning nutritional opportunities and constraints of integrating Family Poultry with other production systems, in particular, forestry, tree crops, annual crops, large animals, fisheries, etc, few responses were obtained from the participants. Chicken/duck-cum-fish farming appeared to be problematic from the environmental point of view. Integration of ducks to rice production system in Asia seemed to be fruitful and that of geese to crop to suppress weed growth was suggested. Indian experience showed integration of FP with horticulture by utilizing droppings for vermin compost and earthworm production as sources of proteins for birds. However, farmers' knowledge on integrated system is required to exploit such an endeavor.

The discussions on opportunities and constraints of using commercial feed for Family Poultry received the largest interest and contribution with more than half of the contributions addressing it. The knowledge and attitudes of FP farmers towards commercial feeds, the types of commercial feeds normally purchased/used by FP farmers, the source of raw materials or ingredients used in feed formulation and the profitability of using commercial feeds were the specific points of discussion. The knowledge of the FP farmers about commercial feeds in general, was considered poor with the exception of those who are producing with commercial strains of poultry. Commercial feeds are being used either by commercial farmers in the interest of ensuring profits or by FP farmers who have native stocks and financial opportunities to buy. The commercial farmers always try to purchase the right type of feed for their birds, but it is not unusual that an incorrect type of feed is purchased to save their birds from starvation at the time of unavailability of alternatives. For the second group of FP producers the selection of the type of feed is not always professional. Usually, there are two sources of raw materials for commercial feed formulation: agro-industrial products/byproducts of local origin and those of imported origin. Importation makes commercial feeds costly and in developing countries they sometimes suffer from quality in the absence of a strong quality control system.

There were differences of opinion among the participants whether using commercial feeds for FP can be profitable. Out of the 24 messages on this theme, 17 participants supported the use of commercial feed. The others were opposed to its use mainly because of economic reasons but also because of limitations coming from the genetic potential of the local poultry. A number of constraints have been identified for using commercial feeds for FP farmers. The indigenous (native) stocks are highly valued because of their brooding and scavenging traits but their low genetic potentiality puts a question on the use of commercial feeds and its profitability. There were reports that feeding commercial feeds for FP can be profitable since the birds are always priced higher (more than double) compared to commercial strains. However, there were also reports about constraints in doing that like wastage of feeds, variation in feed quality, prolonged storage, rodent contamination, lack of access to readily available feeds, alternative feed ingredients or markets, lack of appropriate transport for feeds and high cost. Education and training along with FP rearing information would help in overcoming these constraints and consequently, profits could be ensured. It was concluded that in general due to economic viability, full feeding with commercial feed cannot be recommended. Instead using home-made mixtures from locally available feedstuffs prepared under the guidance of extension workers is recommended.

The last topic of discussion was how to develop and promote improved Family Poultry feeding systems. Different strategies, although not extensive, were suggested by the participants to develop and promote feeding systems for FP. These feeding strategies need to be developed based on the conditions in specific locations (regions) so that homestead leftovers, grains, agricultural by-products can better be utilized. There is a need to educate farmers about commercial feeds, particularly regarding types and quality and to create awareness among them. They should be trained on collecting, mixing and feeding of home-made/home-grown feed ingredients. Minimizing wastage during feeding could economize feeding procedure and improve feed conversion ratio (FCR). Particular attention is needed to consider the situation of indigenous (local) breeds. Inclusion of vitamin-mineral premix or individual mixture (either vitamin or mineral) with local ingredients could be practiced to improve the production. Supplementary feeding of nutritionally balanced feeds to young scavenging birds of chicks/ducklings up to three or four weeks at home in confinement will help gain weight and reduce early mortality. Total confinement of birds for meat and/or egg production by providing balanced diet could be practiced under specific conditions. However, the participants emphasized the need to consider the cost effectiveness of such efforts for birds reared under both scavenging and confinement systems. There were proposals to use locally produced feed ingredients as alternatives to imported ones depending on country and locations. Extension methods and approaches can play a vital role in developing and promoting improved Family Poultry feeding systems. This can be implemented by establishing a model village with facilities for training of FP farmers and dissemination of technologies generated by scientists.

By synthesizing the different views that were expressed by the participants, the following conclusions and recommendations are provided by this report:

- Strengthening research that includes studying the possible impacts of climate change on FP production and ways of mitigating its consequences;
- updating the current method of assessment of SFRB;
- supplementary feeding of nutritionally balanced diets depending on location, seasons, and availability of SFRB;
- increased use of household wastes and crop residues in feeding practices;
- utilization of local feed resources as much as possible as this would result in better production and improved profitability;
- assessment of nutritional needs of different types of FP;
- development of feed formula locally, based on nutritional needs;
- practicing creep feeding of chicks and supplementary feeding of growing chicks and layer birds to achieve higher productivity;
- determination of cost-benefit ratio of feeding commercial/industrial/home-made feed to ensure sustainability;
- Training of FP farmers regarding feeds, nutrition and related poultry husbandry practices to achieve higher outputs;
- conduction of adequate FP research with respect to nutritional aspects, feeds and feed management;
- holding local, regional and international conferences in developing countries to determine future development strategies; and
- planning all development models cautiously and executing those in collaboration with local consultants/experts so that the FP farmers can benefit from the technologies that are generated by research.

2. Introduction

As part of the IFAD funded project "Smallholder Poultry Development Program" a second e-conference about Family Poultry production was organized by the International Network for Family Poultry Development (INFPD) and the Food and Agriculture Organization of the United Nations (FAO). The title of the e-conference was **"Family poultry interactions with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc): Nutritional opportunities and constraints"**. The discussions of the conference took place from 16 January to 17 February 2012 and addressed the following issues:

6. Climate change and the future availability of the scavengeable feed resource base (SFRB) for Family Poultry.
7. Recent development in assessing feed resources for Family Poultry production including the scavengeable feed resource base (SFRB).
8. Nutritional opportunities and constraints of integrating Family Poultry with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc).
9. Opportunities and constraints of using commercial feed for Family Poultry.
10. Developing and promoting improved Family Poultry feeding systems.

A background document was jointly prepared by Dr. S. D. Chowdhury, Professor, Department of Poultry Science of Bangladesh Agricultural University, Mymensingh 2202, Bangladesh and Dr. L. Dibungi, Department of Animal Science of Tshwane University of Technology, Pretoria 0001, South Africa to introduce the above-mentioned topics. A few questions were set in this document for each of the above-mentioned issues to facilitate discussion by the participants. It also contained information about the implementation of the conference and how to participate. A technical committee comprising INFPD scientists (Dr. Olaf Thieme from FAO, Rome, Italy, Dr. E. B. Sonaiya from Nigeria, Dr. Md. A. Saleque from Bangladesh and Dr. E. Gueye from Senegal) assisted in its preparation. Both English and French versions of the document were distributed to the registered participants before the commencement of the conference. Contributions to the discussions were accepted in English and French and translated by Dr. Dibungi into the other language. A total of 210 participants registered for the conference, some of them after the discussions had started. Efforts were made to discuss the different topics separately but all were open for discussion throughout the conference time. Participants from 20 countries actively contributed to the e-conference with 47 messages. In addition four short papers were also submitted and shared with the participants. The contributions were shared with the participants during the e-conference and a list of all messages was also provided to them at the end. The largest number of contributions came from Bangladesh followed by South Africa and India. This document is a summary of the views expressed by the participants in their messages and short papers. In addition to the specific topics that were addressed some general comments of the participants in relation to Family Poultry production system and their nutritional aspects are also considered important and therefore included in the document.

3. Summary of the conference topics

The majority of Family Poultry production in developing countries is practiced with a low input low output system for income generation, poverty reduction, self-employment, women empowerment and house-hold nutrition security of the resource poor. This type of production usually involves flocks of small size that the farmers can afford. The economics of production are obviously an important factor, no matter which type of birds the farmers are rearing. Its interactions with other production systems, nutritional opportunities and constraints in particular are the vital points that need to be considered to accelerate the development process. Keeping this view in mind, this summary of the e-conference presents an account of information synthesized from responses of participants to the different topics that were discussed.

3.1 Climate change and the future availability of the scavengeable feed resource base (SFRB) for Family Poultry

Although climate change has become a global issue and obviously has an impact on the future availability of the scavengeable feed resource base for Family Poultry, only few participants responded to this theme. The paucity of information in relation to Family Poultry (FP) might be one reason for this lack of contribution as the subject is mostly dealt with in relation to other agricultural production systems, and not even in the case of industrial poultry production. Two questions were open for discussion: (a) how and to what extent may climate change affect FP production and the availability of the SFRB and (b) what will be the future availability of SFRB under changing circumstances such as urbanization, industrialization etc?

Competition for foods and feeds between human and poultry necessitates an adjustment of dietary raw materials for poultry production and its utilization depending on seasons of the year. This is changing as a result of climate change (**Mirzaei**, 1¹). FP are raised in the different agro-ecological zones mostly in a scavenging environment that have varying degrees of vulnerability to climate variability and change (CVC). The future availability of SFRB will be affected directly or indirectly (**Ngeno**, 2, **Sonaiya**, 3) through changes in quality and quantity of natural sources of feed and water and also its composition (**Ngeno**, 2). Even the occurrence of cyclones, hurricanes, floods, tidal surge droughts and the uprooting of millions of people due to continuous river erosions (**Pervin**,14; **Ekoue**, 5, 19) have influence on the availability of the SFRB. The changing pattern of ambient temperature, relative humidity, insulation rate etc. may result in the growth of fruit/seed bearing hardier plants that could be utilized for the production of alternate feed resources (**Sonaiya**, 3). But as indicated in a number of previous studies on identification and quantification of crop/crop-gizzard contents it is also widely accepted that the SFRB may even vary without the impact of climate change (**dos Anjos**, 4). It is stated that the impact of climate change may even cause farmers to change the poultry species that they are rearing (**Sonaiya**, 3; **dos Anjos**, 4) although **Dibungi** (13) argued that one species of poultry will not be a true substitute for another. For that reason the impact of climate change should better be addressed by finding new feed resources and using different feeding techniques. **Pervin** (14) emphasized that millions of people have been uprooted because of river erosion in the coastal areas of Bangladesh as a consequence of climate

¹ The numbers given with the references refer to the list of messages prepared from the contributions to the e-conference.

change and that has also limited the availability of SFRB. The productivity of ducks has been found to be season dependent. However, it seems generally accepted that viable data in relation to the impact of climate change on availability of SFRB are still to be generated (**Ekoue**, 5) and this should be a continuous process in order to better judge how FP production system cope under changing situations. **Rangnekar** (22) argued about the use of the term scavenging, suggesting as better term “foraging ” or “free ranging” and expressed the view that the birds have an inherent capacity of coping with changing situations caused by climate change.

3.2 Recent development in assessing feed resources for Family Poultry production including the scavengeable feed resource base.

Gunaratne (15) suggested a further fine tuning of measuring the SFRB to make it more accurate to suit today’s situation by using bird performance in addition to the current method of SFRB measurement. This would not only aid an accurate assessment but also help in verifying the values coming from present SFRB measurements, statutes of utilization of SFRB, quality etc. **Pal and Chatterjee** (17) questioned the quality and safety of the SFRB as it might be a source of contamination with diseases and they demanded implementation of an effective vaccination programme. Referring to an unpublished report **Nayak (30)** indicated that the assessment of the SFRB showed variable results depending on the season of the year. It also showed that the supply of protein was critical in summer whereas energy during the rainy season. The influences of seasons and locations therefore need to be considered while assessing the SFRB.

According to **Swatson** (33), it is desirable to use choice feeding and mixture experiments to complement the efforts of crop content analysis. This will enable the determination of the combination of feed components selected by the FP birds to maximize their biological performance whilst minimizing excesses of nutrient intakes. If this is done for various feeds sources, it may be possible to find out *a priori* whether the supplementary feeding of similar proportions will be suitable to FP or whether no combination of feeds will enable them to make the right choice. A seminar on indigenous poultry of Bangladesh held in January 2012, recommended a correct assessment of the locally produced/available scavengeable feed resources and emphasized indigenous poultry production based mostly on indigenous resources (**Chowdhury**, 43).

3.3 Nutritional opportunities and constraints of integrating Family Poultry with other production systems (forestry, tree crops, annual crops, large animals, fisheries, etc).

There were only few responses of participants to this topic. Integrating FP with other production systems faces some challenges and therefore should be dealt with adequate caution. The most common integration appears to be chicken/duck-cum-fish farming but it is being criticized from an environmental point of view. Unless proper fish poultry ratios are maintained and the production of manure is controlled (**Uwizeye**, 10), this type of integration will remain problematic. The same participant stated that integration of poultry and forestry or tree crop seems to be very difficult to manage. However, in Asia (Japan), the integration of ducks to rice production seems to be very fruitful. Ducks eat weeds and insects that constitute a hazard to rice growth and participate to field fertilization. **Swatson** (11) also mentioned such type of integration and gave additionally information about geese

integrated with crops to suppress weed growth in tobacco, maize and possibly cotton production. However, a holistic assessment of the impacts of pesticide use in such a system on meat and egg quality or even the productivity of Family Poultry (i.e. number of eggs, hatchability, shell physical characteristics, sperm quality, yield of the scavengeable resource base (SFRB) is required. The labour requirements to manage an integrated system are higher as the use of less mechanical equipment or chemical plant regulators will require greater labour inputs for cultivating the same acreages. Exploiting additional nutritional opportunities through integration with other crops will require precise farmer knowledge of the interactions of FP with various species of crops or livestock. This could result in benefits through greater sustainability and profitability of an integrated system. Capacity building of farmers through on farm training and further research will be required to make such integration successful.

Singh (23) reported Indian experiences from a project of integration of FP with horticulture (orchards), kitchen leftovers and garden products (fruits and vegetables). In this system, the poultry droppings were used for vermin compost and earthworms' production to be used as protein sources for FP. Scavenging system works well where there is an abundance of biomass (**Nayak, 30**). Increasing insect population, white ants, azolla, green leafy veggies in foraging areas are some solutions in addition to intercropping millets into farming systems.

3.4. Opportunities and constraints of using commercial feed for Family Poultry

This topic received the largest interest and contribution with more than half of the contributions addressing it. The type of Family Poultry (native or commercial) and the farming systems both differ from country to country, and some FP farmers prefer to use commercial feed for their birds. It may be questioned whether this is an appropriate approach in general or whether this will depend on the respective situations and the topic was therefore considered important for the discussion. In order to guide and structure the responses the participants were given five specific questions. The contributions of the participants to each of the points are synthesized as follows:

(a) What is your opinion on the knowledge and attitude of FP farmers towards commercial feeds, including the economic factors, e.g. feed price and return on investments?

It was generally agreed that the knowledge of FP farmers about commercial feeds is poor and because of this fact they usually feed whatever they can get at the time of necessity no matter whether it is for a starter, grower or layer diet (**Swatson, 1a**). However, FP farmers who are involved with producing with commercial strains of broilers and layers, have some knowledge and therefore they are quite aware of what type of feed is to be fed to which type of birds (**Chowdhury, 18**). Since commercial feeds are always costly, they are considered either by the commercial farmers to ensure profitability or by farmers with native stocks who are financially strong enough to afford buying commercial feed without considering economic factors (**Chowdhury, 18**).

(b) Which types of commercial feeds are normally purchased/used for FP?

The farmers rearing commercial strains of birds try to purchase the right type of feed for specific age groups or production purposes if it is available. But it is not unusual that incorrect types of feed are being fed to chickens during the time of scarcity or to bring birds to higher weight. For example, purchase and feeding of broiler-starter feed for commercial

starting chicks is quite common in Bangladesh not only during the time of unavailability but also to avoid the problem of underweight with commercial chicks (**Chowdhury**, 18). But this is not the situation in the case of feeding of indigenous or other local breeds. The farmers purchase and use a variety of commercial feeds on the basis of availability and financial strength. Since the several types of feed are being purchased and used by the FP farmers for backyard chickens particularly for local stocks and breeds, the nutrients that the birds are deriving also vary (**Swatson**, 1a) with consequences of variation in productivity and profitability.

(c) What is the source of raw materials or ingredients used in feed formulation?

The opinions of the participants indicate that the sources of raw materials or ingredients used for feed formulation are not rigid. Rather, two major sources were identified: agro-industrial products/byproducts of local origin and those of imported origin. In countries where major raw materials, micronutrients and feed additives are mostly of imported origin, the cost of the finished products becomes high with the consequence of an increase in the cost of production of broiler meat and eggs. Commercial feeds in developing countries sometimes suffer from proper quality because of inclusion of adulterated raw materials and the prevailing risk of contamination with pathogenic organisms from imported materials, particularly in the absence of strong quality control system (**Chowdhury**, 25).

(d) Is using commercial feeds for FP profitable? If so, what circumstances and production system permit such profitability?

There were differences of opinion among the participants whether or not using commercial feeds for FP is profitable. Out of the 24 messages on the main theme, 17 participants supported the use of commercial feed while the others were opposed to its use mainly for economic reason or because of limitations coming from the genetic potential of the local poultry. In general, commercial feed cannot be recommended at 100% inclusion due to economic viability instead home-made mixture under the guidance of extension workers using locally available feedstuffs is recommended.

While the concept of industrial feeds seemed to be well understood by to the participants, a sort of misunderstanding still prevailed with regards to the term FP. It appeared from discussions on the various points that some participants limited the term FP to indigenous breed/crossbreds kept in backyard and small number as FP only while other participants considere keeping commercial strains in small numbers FP as well. The profitability of producing with commercial strains obviously depends on flock size, may be 300 or more (**Chowdhury**, 25) but profits with rearing indigenous stocks in confinement by feeding home-made balanced feed (**Miah**, Paper 5) as well as with supplementation of commercial feeds for the scavenging chickens (**Sarkar**, 31) have also been reported. **Swatson** (1a) argued that feeding commercial feeds to FP could be unprofitable because such high protein diets would be less efficiently utilized but small scale intensive rearing of native productive breeds/crossbreds whereas feeding could be made profitable if homegrown alternative productions of protein and energy sources are increased.

Fasina (6) expressed the view that no household FP will be economically viable if they feed local breeds a ration that consists of 100% commercial feed. He reported that good results are obtained in Egypt with feeding different proportions of commercial feeds, cereals and household leftovers, vegetables, etc. **Anton (7)** noted that farmers are aware of the proven quality and the impact of the commercial feed but their awareness about the types of feed is minimal. He also suggested mixing of commercial feed with cereals (corn or sorghum), if commercially feasible. Corn followed by soybean is the most used in feed formulations.

Similarly, **Iskandar** (12) suggested mixing commercial layer or broiler feed with maize and rice bran under the guidance of extension workers.

Safalaoh (8) from Malawi questioned the use of commercial feed for FP and strongly expressed the view that considering commercial feed for FP is a joke even an insult as feed cost is exorbitant for people who cannot even afford to pay for their own food. Safalaoh's views on mixing feed are that it does dilute the quality of the feed. This negative perception was partially echoed by **Askov Jensen** (16) who indicated that the use of commercial feed would never be viable in a low input low output operation with indigenous breeds. The same view was expressed by **Chowdhury** (18) who suggested that price and return on investment for commercial feeds in use with small flock sizes need to be considered; the type of feed used by this category depends more on the availability than requirements.

Ekoue (19) is also not in favour of using commercial feed for FP because of genetic limitations of the local breeds but also because the low price obtained for sale of the poultry that does not match the price for the inputs and locally made feed mixtures would be preferable. **André** (Paper 4) also expressed the opinion that using commercial feed concentrates as single feedstuffs to feed FP chickens is not profitable.

According to **Swatson** (21), the constraints to using commercial feed are poor knowledge of feeds and feeding systems, feed quality, prohibitive prices, prolonged storage, rodent contamination, transport etc. Improved farmers' awareness through training, FP rearing information, adequate on-farm biosecurity, an increase in dietary amino-acids concentration, control of energy levels that can negatively affect the carcass, might be considered.

Rangnekar (22) and **Ekoue** (24) argued that feeding balanced concentrates to free ranging birds has a negative effect on the profitability; low profitability could be improved if extension services and technical supports are provided. Furthermore, according to Ekoue raw materials and adulterated local sources are used e.g. rice polish with rice husks. On the contrary, **Apu** (28) finds that the use of commercial feed can be profitable; crop residues and industrial by-products could be used, however knowledge dissemination about its use is necessary. According to **Nayak** (30) no commercial feed is needed; except for feeding chicks up to 4 weeks of age. This was supported by **Sarkar** (31) who reported the results of a six-week experiment showing that supplementing with a 22% crude protein diet increased body weight gain, net profit three times and resulted in a low mortality.

Sarker (32) mentioned that separation of chicks from their mother helps to increase body weight and also increases egg production. **Saleque** (34) suggested that for meat production with local birds, the use of commercial feed may not be cost effective since the feed conversion ratio is high (>4) compared to commercial broilers. But a lower feed conversion than this (3.26) has been reported for indigenous birds of Bangladesh that were reared in confinement (**Miah**, paper 5). For egg production the selling price for egg needs to be considered and there is need to also consider the 3 "A"s in analyzing the cost benefit ratio that are: A= available, A= accessible and A= affordable.

Reporting about the situation in Cameroun **Fotsa** (35) mentioned that commercial feed is expensive because feedstuffs are imported. Similarly, **Souleymane** (37) suggests that because commercial feed is not profitable, the semi-scavenging poultry could be profitable if local feedstuffs e.g. maize, rice, soybean, cowpea, millet, cassava and derivatives are used. **Prasad** (39) stated that commercial feed could be successfully utilized for larger flocks and that the cost benefit ratio is important. **Gondwe** (40) from Malawi recommended using

energy supplements for feeding scavenging poultry and as said before argued that commercial feed does not exploit its advantage as genetic potential of chickens is a limiting factor that makes the operation unprofitable.

On the other hand, **Traore** (46) reported that commercial feed is a very important business in Senegal although maize is fully imported as are more than half of the ingredients that include fish meal, oilseed meals and concentrates. These feeds are not affordable and not available for FP. Through research, it could be possible to review formulas and adapt them to the needs of FP by incorporating local raw materials at a lower cost by using for example by-products from milling like bran, or dried leaves from legumes like Moringa.

Anton (47) reported from a project in Haiti that had been designed with experiences made in Argentina. Using commercial feed alone is not profitable in Haiti and he suggested also the use of home-made feed mixtures using corn, rice, sorghum and beans to which sea shell, bone ash and salt should be added. The program in Haiti as well as in Argentina has a strong awareness and training component for planning crop production both as food for the families and to generate surpluses to prepare home-made feed for the birds.

(e).What are the constraints of using commercial feeds for Family Poultry? How can these constraints be overcome?

Using commercial feeds for FP production has got some constraints. The low genetic potentiality of indigenous or local stocks may not permit profitable production as indicated by a number of participants (**Ekoue**, 19). But the birds are not low producers if brooding and scavenging traits are valued (**Askov Jensen**, 16). Local birds are already accustomed to scavenging on SFRB.

Another constraint is the wastage of feed which is more in local chickens and needs to be minimized by proper management (**Guyonnet**, 20). Although the commercial feeds are always costly, some FP farmers buy them in spite of their poor knowledge. So, dissemination of knowledge by the use of most effective channels of information (**Anton**, 7), trainings or extension services (**Chowdhury**, 36; **Apu**, 28; **Pal and Chatterjee**, 17) are essential. **Swatson** (21) indicated some constraints like feed quality, prohibitive prices, prolonged storage, rodent contamination, and lack of access to readily available feeds, alternative feed ingredients or markets, lack of appropriate transport for feeds. Again, education and training along with FP rearing information would help in overcoming these constraints.

Further reading on the use of commercial feed was recommended by **Guyonnet** (42).

[Oladoja](#) M.A. and [Olusanya](#) T.P. (2009). Impact of Private Feed Formulation and Production as a Tool for Poverty Alleviation among Poultry Farmers in Ogun State, Nigeria. [International Journal of Poultry Science](#), 8:1006-1010.

From the Abstract: A total of ninety-four poultry farmers were selected using a multi-stage random sampling technique; 63.8% of farmers milled their feed privately either on-farm or at commercial milling centres while assurance of feed quality and availability ranked first among perceived impacts recorded. Also, quality of feed ingredients and technical expertise ranked highest amongst constraints of private feed production. Significant relationship was found between farm size (number of birds) and source of feed production as well as constraints to private feed production. It was recommended that research institutes in collaboration with extension agencies should conduct training and hold workshops for poultry farmers to build and increase their

capacities, knowledge and skills to actively participate in private feed formulation and production in the study area in order to improve their livelihood.

3.5. Developing and promoting improved Family Poultry feeding systems

Although this theme was not fully described under this heading, many of the messages (25 in total) and one paper described the different strategies that can be employed to develop and improve feeding systems for FP.

The following was suggested:

- Rearrange dietary combinations according to regions or countries.
- Mix commercial feed with homestead leftovers, grains, agricultural by-products.
- Create awareness and guidance for farmers on what and how to mix feed.
- Separate chicks and creep feed them with commercial feed.
- Adjust feeders to manage feed wastage.
- Integrate feeding systems with other agricultural activities.

Anton (7) suggested to define feeding strategies according to locations (regions) and to improve farmers' awareness on the use of commercial feed. **Iskandar** (12) in response to message 6 (**Fasina**), cited the example of Indonesia where the introduction of an improved local breed in FP was accompanied by training of farmers in mixing commercial layer or broiler feed with local ingredients and its implementation. Committees were put in place for making ingredients and feed available to the group. A system to reduce high mortality rate in newly hatched chicks, the 'basket system' was mentioned by **Askov Jensen** (16). This system uses separation of the chicks from their mother and creep feeding with commercial feed for 4-6 weeks. However, observations are that although mortality was reduced the feed wastage was too high due to lack of training.

Improved egg laying and egg size were obtained with the inclusion of commercially available vitamin and mineral mixture into the daily feed with local ingredients but proper guidance and training were needed (**Pal and Chatterje**, 17). **Guyonnet** (20) in response to feed wastage recommended placing the feed on a raised slatted and covered area and the removing of the wasted feed on a weekly basis which can be used to feed for other 2-3 days.

According to **Ekoue** (24) the use of agricultural by-products by farmers who are preparing their own feed mixes and by adding termites as protein source and vegetables for vitamins has given good results. To make FP a business, a good nutrition is required and cheap feed should be developed based on research.

Chowdhury (27) stated that a good feeding system depends on consideration of the location and country; in general the supplement to scavenging is made of grain and by-products, dry or wet mash spread on the soil or bowl; any improvement has to be cost-effective and this can be achieved by increasing nutrient density of the supplemental feeds. As noted by other participants he believes that finding the nutrient requirements of indigenous birds and the cost-effectiveness of formulating diets in relation to growth and production, good use of commercial feed and avoiding wastage are essential. **Swatson** (21) also emphasized the cost effectiveness in terms of feed cost per kilogram of FP meat produced. **Apu** (28) emphasized the utilization of household wastes and crop residues and

training of farmers since the farmers are reluctant to practice supplementary feeding with nutritionally balanced diets.

Rota (29) reported observations from projects in Swaziland and Laos where chicks are kept separated and brooded artificially from day one up to three/four weeks and fed by a mixture of commercial feed and locally available broken rice or maize (50:50). This is followed by free range rearing with supplementary feeding and available feed ingredients to increase body weight. Similarly **Sarkar** (32), referring to published research results, mentioned how this practice helps to increase body weight of chicks and egg production of the mother hen which can be doubled while at the same time dramatically reducing the mortality of chicks. Quoting from his experimental results **Miah et al.** (Paper 5) showed how feeding home-made balanced feed (not the industrial one) significantly improved body weight of indigenous birds in Bangladesh that were reared in confinement. **Apu** (28) mentioned the importance of utilizing household waste and crop residues for feeding purpose to economize feed cost.

Fotsa (35) reporting from Cameroun proposed alternatives to the expensive commercial feed since ingredients such as soybean cake, groundnut cake and fish meals are imported. He suggested a ration containing maize, cassava root meal, cassava leaf meal, cotton seed cake, fish meal, soya beans, bone meals or oyster shell meal and kitchen salt. In another message, **Chowdhury** (36) referring to his paper "Family poultry production in Bangladesh: Is it meaningful or an aimless journey?" presented at the Asia Pacific Poultry Conference in Taipei, Taiwan in 2011 indicated that scavenging diets are normally low in energy and protein content but high in fibers hence an improvement in their diets either as free choice of individual ingredient or supplementary feeding of nutritionally balanced diet would be needed. Reference was also made to a paper by Alders and Pym (2009) who suggested that low productivity of village chicken could be improved by better nutrition and Sarkar and Golam (2009) who concluded that improved management interventions in the form of early weaning, creep feeding of chicks and supplemental feeding of hens during the incubation period, have the capacity to impact very positively on profitability and income generation. A recent study in Bangladesh with a small flock of indigenous chickens kept in confinement clearly indicated an improvement by feeding home-made high nutrient dense balanced diet. Extension methods and approaches can play a vital role in developing and promoting improved Family Poultry feeding systems. This can be implemented by establishing a model village with facilities for training of FP farmers and dissemination of technologies generated by scientists (**Chowdhury**, 36).

Fadiga (37) reported that housing combined with endogenous feed based on local production increased production with decreased mortality, improvement in hatchability rate and final sale weight at three months. A report based on a PhD dissertation from **Gondwe** (40) indicates that supplementation of energy food by-products such as maize bran during the feed shortage time (rainy season) instead of commercial feed adds value to family chicken productivity and flock sizes. **Fadiga** (45) from Côte d'Ivoire also reported that good results from improved local FP kept in enclosure with appropriate feeders and supplemented with local resources including corn flour (65%), cassava flour (15%), fish meal (20%) or shell (85%), charcoal (10%) and salt (5%) and water. The enthusiasm of female farmers for implementing such practices was notable.

4. Conclusions and recommendations

1. Climate change obviously has an impact on the future availability of the SFRB. In order to cope with it, efforts should be directed to find out new feed resources and feeding techniques. So, research that includes studying the possible impacts of climate change on FP production and ways of mitigating its consequences should get momentum in developing countries.
2. The method of assessment of the SFRB by measuring crop-gizzard contents needs to be updated. The current state of knowledge may help with more accurate assessment if birds' performance is considered.
3. In general feeding FP, more specifically, the indigenous or local breed solely with commercial feed may not be profitable. Supplementary feeding might be the best option depending on location, seasons of the year and the availability of the SFRB. Increased use of household wastes and crop residues may minimize cost of supplementary feeding that should be nutritionally balanced. But it also seems necessary to consider the local situation since there are also reports that show positive profitability of birds reared with either industrial feed or home-made feed under both confinement and scavenging systems.
4. The type of bird to be fed, level of supplemental feed in terms of home-made or industrial origin and profitability of such endeavor will therefore depend on the country, location within a country and the SFRB. There was consensus that local feed resources should be utilized as much as possible as this would result in better production and improved profitability. The research results that were presented are supporting these statements.
5. Feed formulations for FP that are based on locally produced/available raw materials are advantages compared to costly commercial or industrial feeds. Feed formulae therefore need to be developed locally that rely on an assessment of nutritional needs of different types of FP to augment production under varies systems of rearing.
6. Interventions like separation of chicks from their mother at three or four weeks, creep feeding of chicks and supplementary feeding of growing chicks and layer birds appear to be effective to achieve higher productivity.
7. The cost benefit ratio of feeding commercial/industrial/home-made feed appears to be the major factor for FP production no matter whether such feeding is practiced in confinement or offered as supplementary feeding under a scavenging system. Sustainability is a major factor since the FP farmers would not only like to see more production but also more profits and good use of their inputs.
8. Training of FP farmers regarding feeds, nutrition and related poultry husbandry practices is essential to bring an improvement in the feed formulations, feed management and the system of production overall to achieve higher outputs. The extension staffs of Governments, NGOs and from the private sectors should play an important role in this respect. Monitoring of production activities of the trained FP farmers and finding solutions to the existing problems by the extension workers should back the production process.
9. Adequate FP research with respect to nutritional aspects, feeds and feed management is important. Since it is expected that FP production in developing countries will continue to grow in the future decades, the International Network for Family Poultry Development can play a significant role to enhance the productivity of FP in developing countries in the interest of ensuring food and nutrition security.

10. Local, regional and international conferences should facilitate open discussions amongst scientists of developing countries regarding ongoing activities and to determine future strategies in order to make FP a valuable and viable asset for food and nutrition security in developing countries.
11. Sustainability is a major issue for all development programmes in developing countries. While exploring nutritional opportunities to overcome existing constraints, all development models should be cautiously planned and executed in collaboration with local consultants/experts so that the FP farmers can benefit from the technologies that are generated by research.

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Distribution of the contributions from the participants by country

Country	Number of messages/papers	Message No
Argentina	3	7, 9, 47
Bangladesh	12	14, 18, 25, 27, 28, 31, 32, 34, 36, 38, 43; Paper 5
Cameroon	1	35
Côte d'Ivoire	1	45
Denmark	2	16, 44,
France	2	10; Paper 4
India	5	17, 22, 23, 30, 39
Indonesia	1	12
Iran	1	1
Italy	3	26, 29, 37
Malawi	1	40
Mozambique	3	4, 41; Paper 3
Netherlands	1	2
Nigeria	1	3
Senegal	1	46
South Africa	7	1a, 6, 11, 13, 21, 33; Paper 1
Sri Lanka	1	15
Togo	3	5, 19, 24
UK	1	8
Not defined	2	20, 42
Total	52	