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Editorial

Greetings and best wishes to our esteemed Readers

Farmers as well as the entire nation heaved a sigh of relief with the announcement, by central government, of repealing the three controversial Farm laws which have been an issue of heated debate and discussion on every platform. Farmers' agitation, which has been going on for more than a year, comes to an end, and now farmers can go to their farms and focus on their future farming goals & strategies. The strife around these farm laws can be described by a critics as 'a necessary short term pain for long term gain' and by another as 'seeds of hope for the future of farming in India'. Stubble burning is another issue which gets lots of (unnecessary and avoidable) media coverage at this time of the year, and unfortunately farmers are blamed for this. Everyone including the farmers are concerned for environmental pollution but blaming farmers for this curse is not a good omen. The government should formulate relevant policy guidelines and undertake specific measures so that rice stubble is safely disposed-off. There have been some efforts in this direction but much more needs to be done to settle this burning issue amicably. Further, paddy harvest of the current season is looking good and we may have a record rice procurement by the government agencies. The increasing foodgrains production has come as a relief as it helped the government to provide free additional ration to the poor families reeling under the Covid pandemic uncertainties. The Indian agriculture sector, which was among the few segments that remained robust amid the pandemic era, is expected to register a growth rate of 3.5 per cent in the current financial year ending March 2022.

The current issue of IFD contains 15 articles on varied and diverse topics of current importance. The new issue of IFD starts with an article on Kinnow which has recently as a good alternative to Oranges. The first article on Kinnow delves into the problems of fruit drop and its causes and the potential solution. Next article is on Genetically Modified Crops which have been debated and discussed at length from various perspective. With increasing technology integration in agriculture sector, several Agriportals have come up. Third article explores the role and potential of Agriportals in farming community. The remaining articles also explores the innovative and useful subjects which are of importance for farmers as well as agriculture professionals. I hope that our esteemed readers will find all these articles informative as well as interesting.

Dr. M. A. Ansari

AGRO-WORLD

NEWS ROUND UP

Government is Providing 55% Subsidy on Various Irrigation Equipment

Union Minister of Agriculture and Farmers Welfare Narendra Singh Tomar said that the Department of Agriculture and Farmers Welfare (DA&FW) has launched Per Drop More Crop component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY-PDMC) from 2015-16 in all the states in India. The scheme focuses on enhancing water use efficiency at farm level through Micro Irrigation viz. Drip as well as Sprinkler irrigation systems. The Central Government provides subsidy or financial assistance at 55 percent of the indicative unit cost to the farmers and at 45 percent to other cultivators for encouraging them to install Drip and Sprinkler Irrigation systems under the Per Drop More Crop scheme to enhance the coverage. Additionally, some States provide additional incentives or top-up subsidy to reduce farmers' share for the adoption of Micro Irrigation. Till now, total 1, 85,235 farmers have benefited from the scheme in Uttar Pradesh. The subsidy is released to the farmers electronically through Direct Benefit Transfer (DBT).

Source: Krishi Jagaran

India signs up to COP26 action agenda on sustainable agriculture

India is among 27 countries to sign up to a sustainable agriculture action agenda at the conclusion of the first week of the COP26 climate summit in Glasgow, laying out new commitments to make farming more sustainable and less polluting. The 'Sustainable Agriculture Policy Action Agenda for the Transition to Sustainable Agriculture and Global Action Agenda for Innovation in Agriculture' was among the highlight action pledges to be clinched by the participating countries at the 26th Conference of Parties (COP26) of the United Nations Framework Convention on Climate Change (UNFCCC) on Saturday. The countries laid out new commitments to change their agricultural policies to become more sustainable and less polluting, and to invest in the science needed for sustainable agriculture and for protecting food supplies against climate change. "If we are to limit global warming and keep the goal of 1.5 degree Celsius alive, then the world needs to use land sustainably and put protection and restoration of nature at the heart of all we do," said Alok Sharma, the Indian-origin UK Cabinet minister, in his role as the President of COP26. "The commitments being made today show that nature and land use is being recognised as essential to meeting the Paris Agreement goals, and will contribute to addressing the twin crises of climate change and biodiversity loss. Meanwhile, as we look ahead to negotiations in week two of COP, I urge all parties to come to the table with the constructive compromises and ambitions needed," he said. Others besides India to sign up to the action plan include Australia, Uganda, Madagascar, Tanzania, Vietnam, Nigeria, Lesotho, Laos, Indonesia, Guinea, Ghana, Germany, Philippines, Ethiopia, UK, Colombia, Costa Rica, Morocco, Netherlands, New Zealand, Nigeria, Philippines, Sierra Leone, Spain, Switzerland and the UAE.

Source: The Economic Times

World's Longest Grain Basmati Rice: Incredible Features and Types

What type of rice do you cook? Have you ever cooked the world's longest-grain rice? Yes, it's a Basmati rice variety, but not the traditional one that you usually cook. It is different. It is Pusa 1121. Is this the rice in your kitchen? In Kharif 2003, IARI (Indian Agricultural Research Institute) had almost done a miracle in rice. They developed world's longest grain rice variety Pusa 1121. It was developed by two brothers –Devesh Mittal, who won the Padma Shri, and Aman Mittal. This rice variety has extraordinary long grain, upto 0.33 inches (8.4 mm). This is the longest-ever known rice grain in the world.

Source: The Economic Times

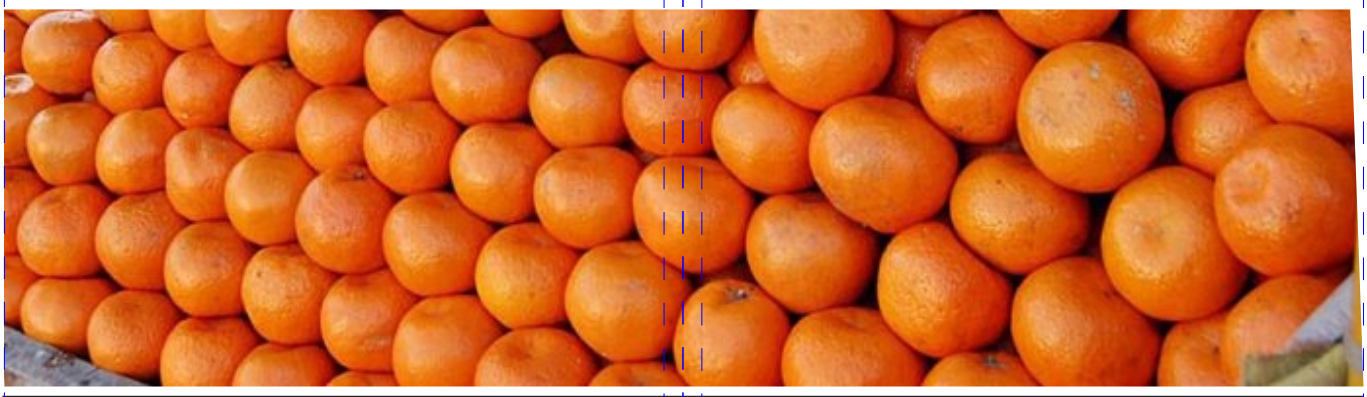
Integrated Management of Fruit Drops in Kinnow

Randhawa H.S.[1], Rajwinder Kaur[2], B.S. Dhillon[3] and Damanpreet[4]

The Kinnow orchards are more profitable than other fruit crops. This fruit crop ranks first with respect to area and production that brought Golden Revolution in North India. The kinnow fruits are rich source of vitamin C, A, protein, phosphorus, calcium, iron and essential oils that may helps to create immunity in the human body. Heavy shedding of flowers and fruits, right from the flowering stage upto the time of harvest is a serious problem in kinnow fruits. Therefore need to take timely preventive measure to obtain better yield and quality of kinnow fruits.

The kinnow growers are requested to follow the following preventive measures :

- Keep the orchards neat and clean.
- Crop should not be water stressed during fruiting period as water stress accelerates the synthesis of abscissic acid which fastens the abscission of fruits.
- Proper arrangements for drainage should be made to avoid water stagnation
- The kinnow trees require a good balance of macronutrients and micronutrients to develop sufficient foliage to support the developing fruits. So apply recommended fertilizers to maintain the healthy and vigorous growth of the trees. Apply entire farmyard manure during December, half dose of Urea and whole phosphorus in February and the second half dose in April-May after fruit set. Spray the plants with zinc sulphate (470g) + manganese sulphate (330g) in 100 litres of water in end of April and mid August for Zinc and Manganese deficiency. A gap of one week should be kept between the foliar application of Bordeaux mixture and zinc sulphate & manganese sulphate solution.
- The plants up to the age of 3-4 years, should be irrigated at weekly intervals, whereas, older trees be irrigated after 2-3 weeks interval, depending upon the climate, rainfall and type of soil. Irrigation is crucial before sprouting in February, after fruit set in April and in the hot weather, otherwise the growth of trees may be adversely affected resulting in the excessive shedding of flowers/ fruits.
- Destroy the ant nests in the orchards.
- Do not allow the branches of trees to touch the ground.
- Prune or remove the diseased infested branches in January -February and destroy them properly.
- Apply Bordeaux mixture (2:2:250) or Copper Oxychloride 50 WP @ 3 g per litre of water after pruning. The other three sprays of these chemicals should be given in March, July and September to reduce the dieback of twigs. For preparation of **Bordeaux Mixture take** Copper sulphate (98 % purity), freshly burnt limes (Quick unslaked lime free from earth and sand) and water @ 2, 2 kg and 250 litre, respectively. Solution of copper sulphate and lime should be made separately. For preparing this mixture, dissolve 2 kg of copper sulphate in 125 litres of hot water. Do not dissolve



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Plant age (year)	Farm Yard Manure (kg/plant))	Dose per plant (kg)	
		Urea	Super Phosphate
1-3	10-30	240-330	-
4-7	40-80	1000-1500	1370-2400
8 & above	100	2000	2730

Fruit fly adults laying eggs and PAU Fruitfly trap

copper sulphate in a metallic vessel. Slake 2 kg of quick lime in another vessel and add water slowly, when the lime is completely slaked, add enough water to bring it up to 125 litres. Then mix the two solutions either by pouring the copper sulphate solution into the lime solution slowly or the two solutions together into a third vessel. Pour the lime solution through a strainer to keep back all lumps. Stir the mixture all the time while pouring. Stir and strain the mixture again when pouring into the sprayers.

- Collect and destroy the mummified fruits on the trees as well as the fallen fruits by deep burying. Do not keep heaps of dropped fruits anywhere in the orchard as they act as carrier for diseases.
- Fruits flies and fruit sucking moths are most important insect-pests responsible for fruit drop in kinnow. Therefore, need clean culture, orchard sanitation or removal and destruction of the fruit fly infested fruits either by burning or deep burying (60 cm) and ploughing. These practices reduce the infestation or carryover of the pest or expose the pupae/maggots to sun's heat and other predators. Precaution should be taken to press the soil properly so that maggots may not come out of loosely kept soil. This step is very essential for management of fruit flies in orchards, otherwise smell of fallen fruits attracts flies from a distance and this increases the chances of more infestation. This operation should be regularly followed every year in every orchard and in every host fruit crop of fruit flies. Fix 16 PAU fruit fly traps per acre in the second week of August for area wide management of fruit flies and recharge the same after 30 days, if required.

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Genetically Modified Crops: Need enhancing the production

R.S. Sengar

GM technology holds promise to solve some of the basic problems related to agriculture. Therefore, a rational, scientific and evidence–based evaluation of this technology is essential. Since beginning of crop domestication, people have felt the need for improving crop plants to increase productivity and enhance the quality of food grain to satisfy the human needs. Traditionally, various plant breeding methods were used by plant breeders for increasing crop production. These conventional plant breeding methods were very successful and helped to meet the demand of the growing population.

Another strategy for crop improvement is the transfer of one or more desired genes from sexually compatible or incompatible species or the selective modification of DNA sequences using recombinant DNA (rDNA) technology. Crops developed using rDNA technologies are called genetically modified technologies crops (GM crops) or transgenic crops. Antibio0tic resistant tobacco was the first GM crop plant in the world developed in 1983. In 1992, China was the first country to approve commercialization of transgenic tobacco resistant to cucumber mosaic virus. In 1994, the US also approved the first GM tomato "flavr savr" for the commercialization. After this a number of GM crops like glyphoste resistant soybean, Bt cotton, Bt maize, virus resistant squash, etc. have been approved for commercialization in different countries. The area under GM crops in the world is increasing every year and in 2014 it occupied 181.5 million hectares in the world. Around 18 million farmers from 28 countries are involved in cultivation of GM crops. In 2013, Marc Van Montagu, Merry-Dell Chilton and Robert T. Fraley were awarded the World Food Prize for developing a transgenic plant by transferring bacterial gene for the first time.

In India, the first GM crop is Bt cotton was introduced in 2002 against the cotton bollworm (Helicoverpa armigera). Cotton bollworm is a major pest of cotton. For eradication of this pest, farmers have been using multiple sprayings of chemical pesticides. Bt cotton contains the cry gene obtained from Bacillus thuringinesis (Bt) bacteria which is an insecticidal protein. When the bollworm feeds on the Bt cotton plant, the cry protein, which is a protoxin, enters into the insect's mid-gut and due to the alkaline pH of the mid-gut it gets cleaved by the gut protease to from delta-endotoxin, the endotoxin binds to mid-gut epithelial cells and forms pores in the cell membrane and ultimately kills the insect. This makes Bt cotton resistant to the bollworm. The use of Bt cotton has resulted in reduction in application of chemical pesticides, thereby reducing the negative impact of pesticide residues on the environment and the farmer is thus able to save the money spent on pesticides. Within 12 years of of its introduction in India, it has occupied nearly 90% of the total cotton growing area. India used to be an importer of cotton before 2002, but after commercialization of Bt cotton, India became a leading exporter of cotton in the world.

Brinjal (Egg plant) is one of the main vegetables in India. The major problem in brinjal is the infestations by fruit and shoot borer (*Leucinodes orbonalis*). The larvae feed inside the fruit, due to which the fruit is not suitable for human consumption. A single larva can damage 4-6 fruits. Sometimes excess infestation results in total failure of the crop.

For the control of brinjal fruit and shoot borer, farmers are using excess of pesticides which is harmful for the environment and human health. Maharashtra-based seed company Mahyco has developed Bt Brinjal that containsCry1Ac gene from Bt bacteria, which renders the brinjal crop resistant to fruit and shoot borer. The GEAC (Genetic Engineering Appraisal Committee) which permits the commercialization of GM crops in India approved Bt brinjal for commercialization in 2009. However, soon after the approval several scientists, farmers and some Non Government Organizations

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(NGOs) raised certain questions about its biosafety which delayed its release. Therefore, in February 2010, the environment Ministry issued a moratorium on the release of Bt Brinjal in India. However, Bangladesh approved Bt Brinjal for seed production and initial commercialization on 30 October 2013. In the next coming years Banglades is planning to increase the area under Bt Brinjal (Source ISAAA). Now, what are some environmental, economical and health related issues due to which some scientists, NGO and others are criticizing this GM technology? Let's take a look.

Environmental issues

Biodiversity: Biodiversity refers to the diversity in all forms of life present in earth. It can be genetic, species or ecosystem diversity. Humans have dominated the planet and changed the planet according to their needs which has resulted in the loss of biodiversity. Agriculture, industrialization, loss of forest, loss of habitats, and climate change are some of the main reasons for this loss of biodiversity. Agriculture practices like ploughing, tilling, monoculture use of herbicides, pesticides and insecticides results in loss of beneficial insects, plants and other forms of life that ultimately results in loss of biodiversity. Loss of biodiversity is a general problem associated with present-day agriculture.

In 1999, a paper was published in the Nature magazine which reported the detrimental effect of Bt maize on Monarch butterfly, which is an endangered species of butterfly found in North America. When the butterfly larvae were fed on milkweed leaves (Monarch butterfly larvae feed only on milkweed leaves) covered in Bt maize pollen, it failed to grow. This led to concerns that Bt crops could give rise to major environmental problems. Later, a different group of scientists analyzed the Bt pollen toxicity to monarch butterfly. They found that one of the vents Bt176 which contains a pollen specific promoter had high level of cry protein expression (1.1-7.1 microgram per gm) leading to the toxic effects observed on the butterfly larvae. So Bt176 event has now been removed from the market. In 2011, a review was published on "I*mpact of Gm crops on biodiversity*" (Janet E. Carpenter, 2011, GM Crops, 2:1, 7-23). In this review, it was concluded that GM crops had reduced the impact of agriculture on biodiversity. Cultivation of insect-resistant GM crops reduces the application of insecticides and pesticides and thus prevents the killing of beneficial insect population. Similarly, herbicide–resistant crops. Result in less tillage and preservatio0n of soil moisture.

Gene flow and cross pollination: Gene flow refers to the transfer of gene or genetic material from one plant species to other plant species. It is a natural process that may lead to evolution of new species. Gene flow can occur in two ways either from the crop to its wild relative or from crop to weed plant. Gene flow can result in contamination of wild relatives of crop plant which results in reduction of germplasm or transfer of novel trait into the weed plant (can give rise to superweeds). Serious consequences can occur, so avoiding gene flow in case of transgenics is necessary for which various strategies have been proposed (Table 1).

Superweeds: Superweed is a plant that is resistant to some dose of herbicides. Superweed may arise due to continuous use of single herbicide or gene flow from transgenic to weed species. It is true that herbicide-tolerant GM cropsn have given rise to Superweeds but the Superweed also occurs in conventional agriculture. Even before commercialization of GM crops there were certain weeds that were resistant to herbicides. There are around 24 glyphosate-resistant weeds that emerged after the release of glyphosate-resistant crops, but there were around 64 atrazine-resistant weeds even before the development of atrazine-resistant crops (Table 2).

Table 2 : Number of resistant weeds for different herbicides

Herbicide	No. of resistant weeds
Atrazine	64
Imazethapyr	39
Tribenuron-methyl	35
Imazamox	32
Chlorsulfuron	31
Simazine	31
Paraquat	26
Glyphosate	24

Table 1: Different strategies for avoiding gene flow

Strategy	Principle
Chloroplast transformation	Expressed gene in chloroplast which is maternally inherited
Male sterility	No pollen production
Terminator technology	Seeds are sterile
Spatial isolation	Physical barrier (tall crop, hedge, tree) between GM and non GM crop usually at the boundary of the crop
GM crop-fre zone	Select some region where wild relatives dominate and declare that region as GM-free region

Superweed is not a new problem that came as a result of the introduction of GM crops. However, they can be destroyed by different types of herbicides and by different crop management practices.

Economics issues

Multinational companies in agriculture sector: Development of GM crops involves various steps like gene isolation, cloning to plant transformation, regeneration, phenotypic and molecular analysis, multilocation field trials and analysis of various biosafety parameters, etc. It involves a large amount of money, that's why most of the transgenic crops that are commercially cultivated in the world now have been developed by multinational companies (MNCs). MNCs existed in agriculture even before the advent of GM technology. Most of the herbicides, pesticides and seed companies are multinational. Hence, the argument that GM crops will let in multinational companies in agriculture is not appropriate. There are some projects of GM crops that have a humanitarian aim. Golden rice is one of the examples. The development of golden rice involves 70 different Intellectual Property Rights (IPR). A free license has been granted for the Golden rice on humanitarian grounds by the IPR holders.

Seed purchase and coast: Farmers usually store some parts of seeds after harvest and use it the next year. Terminator seed technology can develop seeds that will not germinate in the subsequent year so farmers have to purchase new seeds every year. But this technology is not approved for use. There is no terminator seed of any crop available in the market. Although in case of hybrids farmers have to purchase new seeds every year whether that hybrid is Gm or not. However, GM seeds are costly as compared to their conventional non-GM counterpart.

Farmer's profit: There is a continuous debate among different groups worldwide that GM crops reap benefits for MNCs only, while some groups consider that the farmers are benefited as well. Jonas Kathage and Matin Qaim have studied the economic impact of Bt cotton in India. They carried out an analysis on 533 small household farmers involved in cultivation of Bt cotton with an average cotton area of 3&4 acre in the states of Maharashtra, Karnataka, A.P. and Tamil Nadu taking different parameters like seed costs on spraying chemical pesticides, yield and overall income. Their results showed that the cotton yield has increased by 24% and the profits of farmers have gone up by 50%. Although Bt cotton seeds were costly than their conventional counterpart, the farmers income increases to higher yield and reduced application of pesticides.

Health issues

The public concern about GM cops is the safety of GM food. Today, consumers are interested in knowing about the source of food they consume. So, the question about the safety of GM food is obvious. Before the release of any GM food, it is evaluated for various biosafety parameters and then only it can be released for human consumption. It has never happened in the past that such evaluation has taken place before the release of any crop for human consumption. Another concern is about eating genes and DNA in food from GM sources. All foods contain genes and DNA that get digested and disposed off in the usual way. Humans have been consuming genes since evolution but there is no report that genes can enter human cells from food.

Despite the fact that GM food is carefully assessed, various controversies happened in past regarding safety of GM food. In the 1990s, Dr. Arpad Pusztai claimed that rat fed on GM potato had serve immune system damage and stunted growth. However, it was not made clear that the research was experimental and the potatoes were not being developed as food crop. Later, a number of studies have been published which showed that experimental design, technique and data was insufficient to draw any conclusion from it.

Starlink is a maize variety which was released for animal feed. It was not released for human consumption because it contains cry 9C gene which is stable at acidic pH. In 200, contamination of Starlink maize in human food was observed. Therefore, it was removed from market. Another example dates to 2004 when a large number of people in a village of Philippines showed allergic reaction that caused a range of symptoms. Again a controversy was created that this allergic reaction was due to Bt cotton. Therefore, to settle concerns about the safety of GM food several questions need to be answered, such as, how the safety of GM crops should be measured, what are the features that are to be tested, what kind of analysis is required, what are the parameters of biosafety that need to be tested, and so on. GM technology holds promise to solve some of the basic problems related to agriculture. Therefore, a rational scientific and evidence-based evaluation of this technology is essential.

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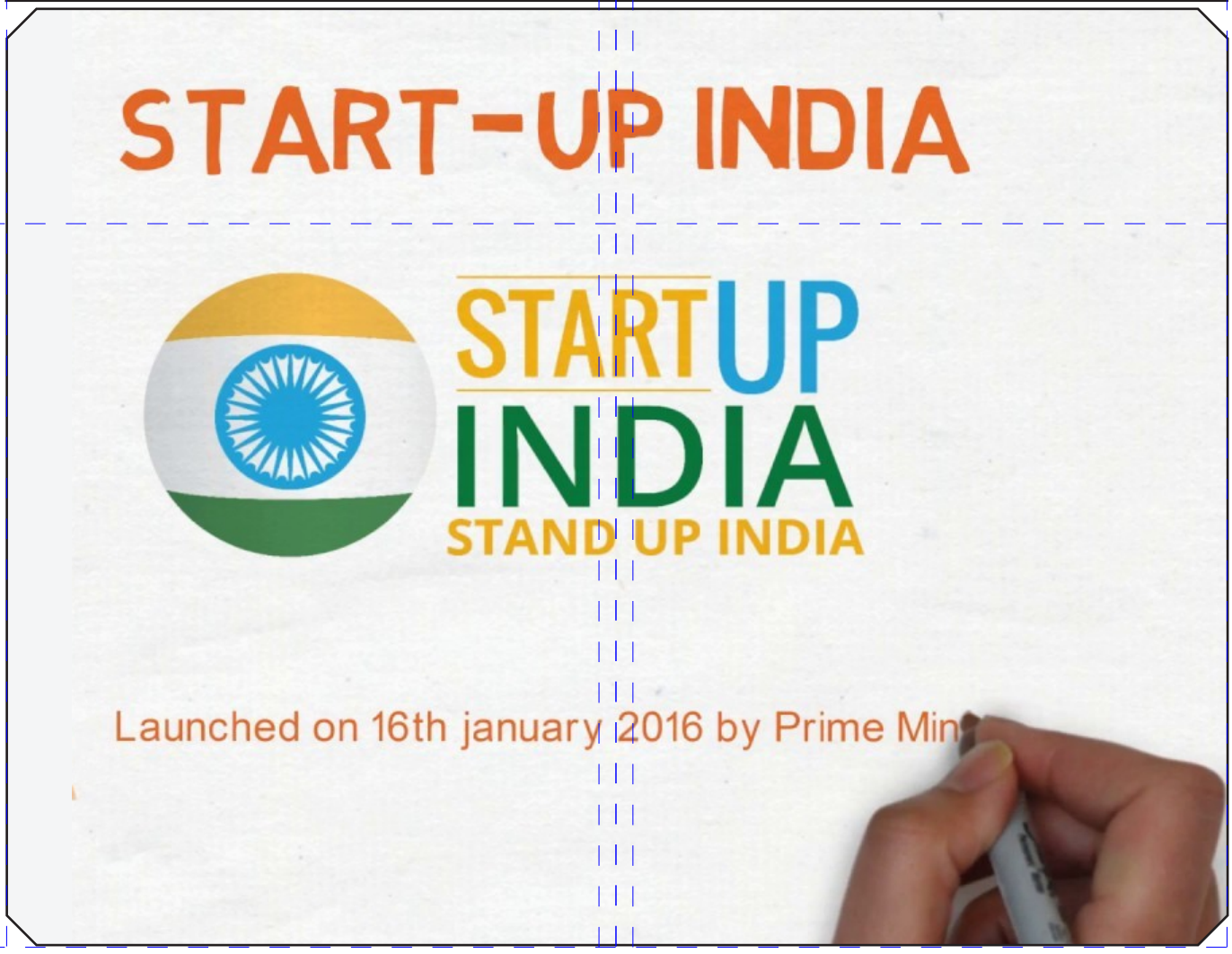

Role of Farmers Portal in development of farming community

Arpita Sharma

India is an Agricultural economy. Agriculture sector play a major role and contribute in GDP of the country. Agriculture or farming is the major source of livelihood in rural India. This sector is a large sector and divided into sub segments as food, dairy, meat, poultry etc. As Mahatma Gandhi said, "India lives in villages and agriculture is the soul of Indian economy". Nearly two-thirds of its population depends directly on agriculture for its livelihood.

Agriculture is the main stay of India's economy. Past researches revealed that Indian Farmers play an important role in the development of our country but due lack of knowledge and information on various aspects an Indian Farmers are suffering from various types of problems. That's why Government has initiated various digital platform where farmers can get information on various aspects. Present paper aim is to discuss the agriculture website or portals for the development of farmers.

Agriculture
https://www.india.gov.in/topics/agriculture
by department of agriculture and cooperation

Farmers' Portal is an online platform for farming community initiated by Department of Agriculture & Cooperation. This platform provides the detailed information on farmers' insurance, agricultural storage, crops, extension activities, seeds, pesticides, farm machineries, Details of fertilizers, market prices, package and practices, programmes, welfare schemes etc. Besides all these information, this online portal provides brief information on fertilizers, market prices, package and practices, programmes, welfare schemes etc. This portal is divided into different segments. These segment cover the information on Agriculture, Environment and forest, Science & Technology, Art & Culture, Information & Broadcasting, social Development, Health & Family Welfare, Labour & Employment, Rural development.

mKisan portal
https://mkisan.gov.in/

mKisan was initiated in the year July 16, 2013. mKisan SMS Portal is other online platform for farmers. This portal enables all central and State government organizations in agriculture and allied sectors to give information/services/ advisories to farmers by SMS. This information provides all updates related to agriculture in the local language. Under the National e-Governance Plan - Agriculture (NeGP-A), various other services are also provided as internet, touch screen kiosks, agri-clinics, private kiosks, mass media, Common Service Centres, Kisan Call Centres etc. With this portal, 327 crore messages or more than 1044 crore SMSs have been sent to farmers. These messages are based on the needs of farmers. Online portal also provides value added services viz; USSD (Unstructured Supplementary Service Data), IVRS (Interactive Voice Response System) and Pull SMS. Voice messages are also useful for the illiterate person.

Farmers' portal
One stop shop for farmers
https://farmer.gov.in/

This portal provides the relevant information and services related to farming. This portal works on the concept of one stop shop. With this portal farmers will get information on various aspects.

Agropedia

This is also online service which provides update information to farmers. Other website as, uasr.agropedia.in, iitk.agropedia.in also provides the information on fareming. This web provides the information on different coloum viz; Krishi Vichar, Agrowiki, Agroforoum, Knowledge Models, Library, Agroblog etc.

India agri stat
Revealing Agriculture in India Statistically

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www.indiaagristat.com

This website is a complete source of Indian Agriculture Statistic. This website is updated regularly. This website updated information on different sectors viz; Agriculture, Agriculture Exports, Imports, Horticulture, Fisheries, Kisan Credit Card etc. This data has been used by Indian Agriculture Research Institute, Agriculture Research etc. This website also provides the information on socio-economic news, socio-economic videos, publication, events and announcement etc. This site is very much helpful for farmers.

Indian agriculture professionals (IAP)
www.isapindia.org

This site is started by Indian Society of Agribusiness Professional. This site helps farmers and community. This is a network provides information on Agriculture and allied sector.

Food corporation of India
www.fciweb.nic.in

This website is started by Food Corporation of India. This site provides the information on procurement, storage, movement, finance, sales, stocks, quality control etc. There are different sections in the website as employment corner, report and publications, press Release, RTI, GST etc. This site provides the information on food security, price stabilization and distribution of food grain for the benefits of farmers.

Department of agriculture, cooperation and family welfare
http://agricoop.nic.in

This website provides information on Agriculture, employment, opportunities, industrial sector and infrastructure etc. This site also presents the information on plant protection, information network, different Government schemes etc. This site provides the information of digital agriculture, soil health card, electronic market platform, e-nam, Pradhan Mantri Fasal Beema yojana etc. During covid period different types of webinars are also organized as reforms in Indian agriculture, Ushering a new dawn in Agri Reform etc.

Apeda.com
www.apeda.com

Agricultural and Processed Food Products Export Development Authority (APEDA) website provides the information related to export promotion and development of products as horticulture, floriculture, vegetables, processed foods, dairy products etc. This site also responsible for export of non-scheduled items as wheat, rice, sugar etc. This site front page displays related link as state, aliexpress dropshipping centre, exporter India, Canton fair 2020, exporter India etc.

Government of India
Department of fertilizers
http://fert.nic.in

This website provides the information related to fertilizers. This website also displays different types of projects related to fertilizers as Hindustan Urvarak & Rasayan LTD. (HURL), Ramagundam Fertilizers and Chemicals Limited. (RFCL), Talcher Fertilizer LTD. (TFL) etc.

Ministry of food processing industries
http://mofpi.nic.in

This site provides the information on different aspects as Government Schemes, Atmanirbhar Bharat, Operation Green Scheme, Management System, Investor facilitation etc. This scheme also provides the information on job opportunities in rural areas, benefits of modern technologies etc.

Kisan seva yojana
http://www.upagriculture.com/

This is UP Agriculture website. This website provides the information on different schemes for farmers, updates on portal, online seed monitoring system, recent updates for farmers.

Case study

K.C. and Timalsina (2018) in their research "A Case Study on Agro-based E-Commerce Portal investigated the practice of E-Commerce portal named Metrotarkari for marketing vegetables and fruit items in Kathmandu valley. A case study approach underpinned the study so as to identify current issues and practice of E-Commerce portal for

vegetable and fruit items thereby adopt appropriate strategies for its sustainability in this sector. The study used explanatory form of analysis on the issues of business model, payment system, distribution system, overall challenges and marketing strategies based on the face to face interview with chief operating officer of Metrotarkari. The result shows that their B2B feature is serving more customers than B2C feature does in daily basis. The cash on delivery has been the preferable option of payment system although they have facility of Paypal, E-Sewa and Sctmoco. The main reason behind the problem in maintaining and delivering quality items is the lack of their own inventory and their dependency on others vendors. Establishing their own cold store or inventory and appending the C2C feature in their existing portal are major suggestions made to provide benefit to farmers and customers thereby sustain in this sector. SWOT analysis of Metrotarkaria) Strengths: Ordered item distribution system Free delivery strategy Product varieties-more than 30 seasonal items which is not available in local market easily Increasing number of customer in B2B model b) Weaknesses: Inadequate research on market and customer satisfaction Lack of adequate facilities No precise delivery timing Compromise in product quality) Opportunities:Growing internet and Smartphone users increasing Publics' literacy rate and awareness is increasing Advertisement on Social media such as Facebook and Twitter increasing number of customer) Threats:New competitors based on online groceries such as Sastodeal, Chizbiz etc. Traffic congestion and difficulties in location finding Unmanaged urbanization Payment system complexities. The finding of the present study is different in the Latin American background where it is found closer in Indian background. As per the report by Statista, in Latin America the majority (65 per cent) of online shoppers preferred to pay via credit card. A total of 36 per cent of shoppers opted for digital payment systems where 35 per cent shoppers preferred cash on delivery option. On the same context, preferred payment method of online shoppers in India was to pay via cash on delivery. Cash on delivery forms an important aspect of the online shopping website in Indian online shopping market.

Conclusion

On the above discussion, it can be concluded that agriculture portals provides the right information among the farmers. Farmers can easily get the information on various aspects related to farming.

References

K.C. S. K, Timalsina, A. K. (2018). A Case Study on Agro-based E-Commerce Portal International Journal of Environment, Agriculture and Biotechnology (IJEAB) Vol-3, Issue-1, Jan-Feb-2018http://dx.doi.org/10.22161/ijeab/3.1.27ISSN: 2456-1878.

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Trichoderma: A Biological Weapon against Soil Borne Plant Pathogens

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Biological control is a great renaissance of interest and research in microbiological balance to control soil-borne plant pathogens and leads to the development of a better farming system. In biological control, genus Trichoderma serves as one of the best bioagents, which is found to be effective against a wide range of soil borne pathogens. The various mycoparasitism mechanism employed by Trichoderma are, competition for food and space, secretion of cell wall degrading enzymes, secondary metabolite production, host immune response induction and plant growth promotion.

Biological control of plant pathogens is an attractive proposition to decrease heavy dependence of modern agriculture on costly chemical fungicides, which not only cause environmental pollution but also lead to the development of resistant strains. Use of biological pesticides is continuously increasing due to public concerns about environmental pollution, human health and soil fertility. Biological pesticides are served as an alternative to chemical pesticides. Farmers generally use chemical pesticides to control plant diseases, these chemical pesticides imparts a bad impact on environment. In Europe around 250k tones of biopesticides is consumed annually. There are two types of biocontrol agents generalists (These biocontrol agents are capable of controlling a large number of taxonomically different pathogens e.g. *Bacillus*, *Pseudomonas*, *Trichoderma*, yeast etc) and Specialist (These biocontrol agents are capable of controlling only targeted species e.g. *Agrobacterium*, *Aspergillus* etc). *Trichoderma* species are the most commonly used biocontrol agents. They are commercially marketed as biopesticides, biofertilizers and growth enhancers. The various mycoparasitism mechanism employed by *Trichoderma* are, competition for food and space, secretion of cell wall degrading enzymes, secondary metabolite production, host immune response induction and plant growth promotion. *Trichoderma* based bioformulation are used in greenhouse, nursery, field, orchards and hydrophonics. *Trichoderma* based bioformulations are used for crop protection in whole world. *Trichoderma* species that are most commonly used as biocontrol agents are: *T.harzianum, T. atroviride, T. asperellum, T. polysporum, T. viride* Trichoderma species are also known for their biodegradation capability. *Trichoderma* species have the capability of degrading toxic compounds. *Trichoderma* is highly effective on root rot, foot rot, collar rot, stem rot, damping off, wilt, blight leaf spot of crops like pulses oil seeds, cucurbitaceous crops (cucumber, bottle gourds, ridge gourd) solanacceuos crops like tomato, brinjal, chilli, capsicum etc. *Trichoderma* are also effective against sheath rot, sheath blight and bacterial leaf blight of rice. The positive effects of *Trichoderma* on agriculture crop protection have been recognized in the whole world. Our understanding of the mechanisms of biological control employed by *Trichoderma* is continuously expanding. *Trichoderma* species are well known for the production of cell wall degrading enzymes. These cell wall-degrading enzymes (CWDEs) play a major role in biocontrol mechanism. Soil borne pathogens create major problems in agriculture which eventually reduces plant yield. Soil borne pathogenic fungi *viz*., *Pythium, Fusarium, Rhizoctonia, Sclerotinia, Verticillium, Armillaria* and *Phytopthora* attack most of the economically important crop plants (either through seed before germination or seedling after germination) resulting in heavy losses. So there is a pressing need to control fungal diseases to ensure a steady and constant food supply to ever increasing world population. The development of such a global system for sustainable food production is one of the greatest challenges faced by humans. Conventional practice to overcome this problem has been the use of chemical

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fungicides which have adverse environmental effects causing health hazards to humans and other non-target organism, including beneficial life forms.

Mechanisms of action

There are six different mechanisms by which BCAs (Biological control agents) control other microorganisms; i) direct competition with the target organism ii) Induced Resistance iii) antibiosis iv) predation or parasitism of the target organism v) induced resistance of the host plant and vi) inactivation of the enzymes produced by the pathogen. Most BCAs apply only one of these five mechanisms; however, some may employ more than one. Some of the mechanisms adopted by *Trichoderma* against plant pathogens are described below.

1. Competition

Competition for space or nutrients has long been considered one of the classical mechanisms of biocontrol by *Trichoderma* spp. The competition for nutrients, primarily carbon, nitrogen, and iron is one of the method of the biological control of soil borne plant pathogens. *Trichoderma* species are generally considered to be aggressive competitors and the ability of *Trichoderma* to compete is species dependent.

2. Induced resistance

Induction of resistance in host plant by treatment with the biocontrol agent is another mechanism in biological control. Specific strains of fungi in the genus *Trichoderma* colonize and penetrate plant root tissues and initiate a series of morphological and biochemical changes in the plant, considered to be part of the plant defense response, which finally leads to induced systemic resistance (ISR) in the entire plant (Howell, 2003). The plant response was marked by an increase in peroxidase activity (often associated with the production of fungitoxic compounds), an increase in chitinase activity, and the deposition of callose-enriched wall appositions on the inner surface of cell walls.

3. Biofertilization and stimulation of plant defense mechanism

Trichoderma strains are known to associate with plant roots and root ecosystems. They are also plant symbiont and opportunistic avirulent organisms, able to colonize plant roots by mechanisms similar to those of mycorrhizal fungi producing compounds that stimulate growth and plant defense mechanisms. This mechanism includes plant root colonization and rhizosphere modification.

a. Plant root colonization

It seems logical that a biocontrol agent should grow and persist, or "colonize", the surface of the plant it protects, and colonization is widely believed to be essential for biocontrol. *Trichoderma* strains must colonize plant roots prior to stimulation of plant growth and protection against infections. Colonization implies the ability to adhere and recognize plant roots, penetrating and withstanding toxic metabolites produced by the plants in response to invasion by a foreign organism, whether pathogen or not. Root colonization by *Trichoderma* strains mostly enhances root growth and development, crop productivity, resistance to abiotic stresses and the uptake of nutrients.

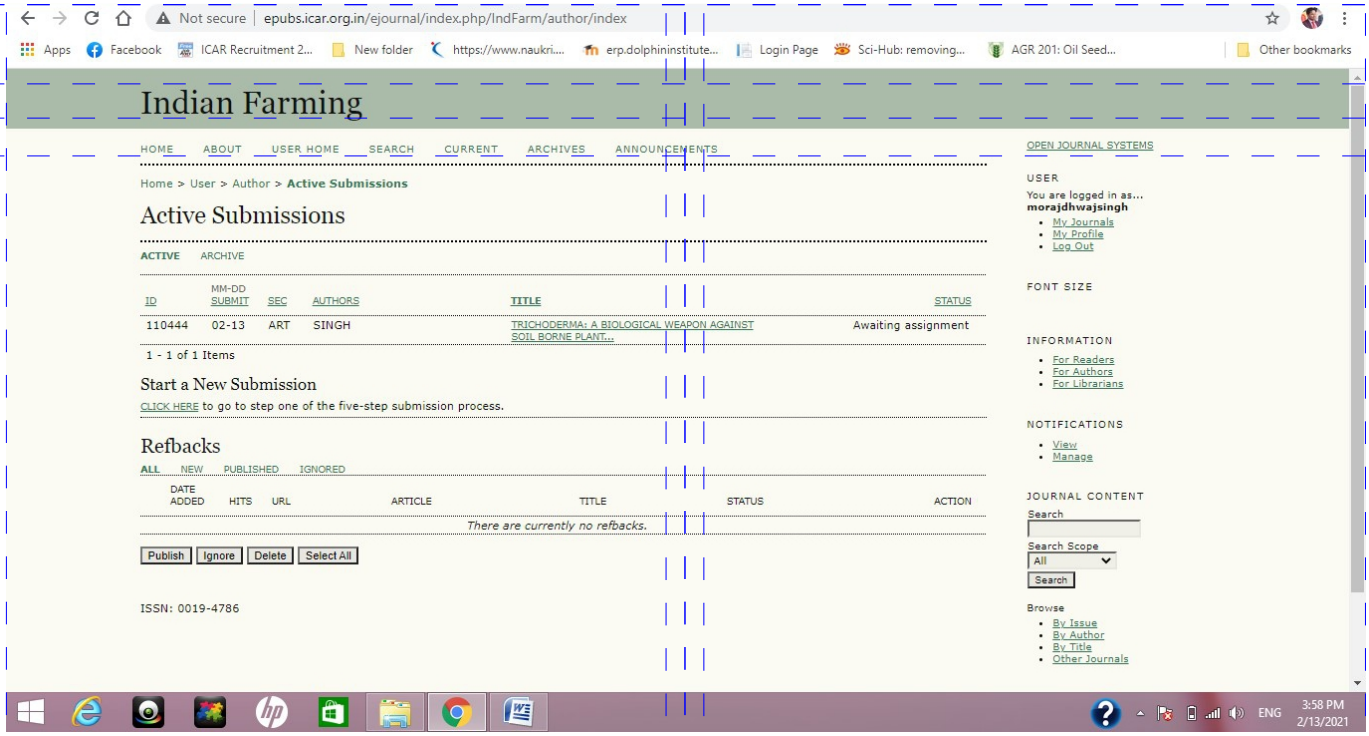
b. Rhizosphere modification

The soil environment influences spore germination, chlamydospore formation and the production of secondary metabolites, such as antibiotics and enzymes. The pH of the microbial environment is one of the major factors affecting the activity of both *Trichoderma* and pathogenicity factors secreted by different microorganisms.

4. Antibiosis

Biocontrol is often attributed to antibiosis. With respect to antibiosis, one or more antibiotics have been shown to play a role in disease suppression. Antibiosis may be simply a highly effective mechanism for suppressing pathogens in the rhizosphere. Antibiosis occurs during interactions involving low molecular weight diffusible compounds called antibiotics produced by Trichoderma strains that inhibit the growth of other microorganisms.

Trichoderma spp. produces alkyl pyrones, isonitriles, polyketides, peptaibols, dikeyopiperazines, sesquiterpenes, and steroids have



been associated with biocontrol activity of some species. Apart from these antibiotics, it produces volatile and non-volatile toxic metabolites *viz*; harzianic acid, alamethicins, tricholin, peptaibols, antibiotics, 6-penthyl-a-pyrone, massoilactone, viridin, gliovirin, glisoprenins, heptelidic acid that impede colonization by antagonized microorganisms.

5. Mycoparasitism

Mycoparasitism is considered an important mechanism of biological control and probably depends on the production of lytic enzymes including Beta-1, 3-gluconase, and proteases.

Mycoparasitism is a complex process including several steps. The initial interaction shows that the hypha of the mycoparasites grows directly towards its host. When the mycoparasite reaches the host, its hypha coils it or attaches to it by forming a hook-like structure. Following these interactions hypha sometimes penetrates the host mycelium, apparently, by partially degrading its cell wall.

6. Inactivation of the pathogen's enzymes

Enzymes such as chitinases and/or glucanases produced by the biocontrol agent are responsible for suppression of the plant pathogen. These enzymes function by breaking down the polysaccharides, chitin, and - glucans that are responsible for the rigidity of fungal cell walls, thereby destroying cell wall integrity. *Trichoderma harzianum* (T39) produces proteases that are capable of degrading the pathogens plant cell wall degrading enzymes, and thereby reducing the ability of the pathogen to infect the plant.

Conclusion

Chemical control methods effects environment and are dangerous to human beings. So, use of biocontrol agents is next best alternative. *Trichoderma species* is cosmopolitan in soil, decaying wood, and in plant organic matter. Many species of genus *Trichoderma* are used as biocontrol agent against plant pathogens in agriculture sector. *Trichoderma* species produce enzymes that degrade call wall and metabolites that helps in plant growth and that fights against plant pathogens. It also has ability to conserve soils by substituting harmful chemicals.

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Cold chain in India: Challenges and Strategies

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Indian economy is based on agriculture, development of cold chain infrastructure will play a crucial role in reducing the losses and wastages, increasing the farmer income, generating employment opportunities for the local people, and improving the livelihood of the farmers which leads to developing the economy and helping India to emerge as a global leader in the food sector. The present study undertakes a review of basic literature available to explain the present status of and challenges to cold chain pertaining to the Fruits and Vegetables (F&V) sector in India. The study is an attempt to draw the attention of the stakeholders towards an urgent need to develop intelligent cold chain infrastructure which is the major impediment and a weak link in the supply chain of F&V sector in India. Cold chain infrastructure facilities include grading, sorting, packing, storage, processing and transportation facilities in the supply chain network.

Fruits and Vegetables (F&V) is a very growing sector and constitutes around 90% of horticultural produce in India. Several factors like globalization, increasing urbanization, nuclear families, working women, disposable income, changing lifestyles and rise of organized retails are gearing up the Indian fruits and vegetables supply chains for a better future. In this sector Supply chain plays a crucial role because of the perishable nature and short shelf life of fruits and vegetables. To maintain the shelf life of produce cold chain infrastructure plays an important role. India over the years witnessed a marked increase in production of perishable high nutrition products like fruits, vegetables, meat and poultry products etc. but development of cold-chain infrastructure was not strategically directed, for safe handling and to convey these perishable products to markets, except in the dairy sector. A resultant demand supply mismatch emerged across these agricultural commodities, frequently contributing to wide spread price fluctuations and inflation.

India is the largest producer of fruits and vegetables in the world. In spite of that per capita availability of fruits and vegetables is quite low because of post harvest losses which account for about 25% to 30% of production. Besides this, the quality of a sizable produce also deteriorates by the time it reaches to the consumer. This is mainly because of perishable nature of the produce which requires a cold chain arrangement to maintain the quality and extend the shelf-life if consumption is not meant immediately after harvest. In the absence of a cold storage and related cold chain facilities, the farmers are being forced to sell their produce immediately after harvest which results in glut situations and low price realization. In such situation farmers do not even get their harvesting and transportation cost. As a result, the production is not getting stabilized and the farmers after doing so much hard work with one crop switch over to another crop in the subsequent year and the vicious cycle continues. Our farmers continue to remain poor even though they take risk of cultivating high value fruits and vegetable crops year after year. Cold storage facilities assure in removing the risk of loss of produce and ensure better returns to the farmers. The cold chain infrastructure has been a weak link in the supply chain of fruits and vegetables as India has incurred huge losses due to poor post-harvest management and infrastructure facilities.

Status of cold storage and its potential in India

Cold supply chain

Cold-chain is a chain of logistics activities that is primarily used to provide connectivity service of perishable produce from harvest to consumers. It is categorized under the logistics sector, cold-chain does not alter the essential or raw characteristics of agricultural produce, but merely pre-conditions the produce and conveys it to consumers. Cold chain system does not add value-into the produce it is for safe custody and transport of the produce in the fresh form. A cold-chain system will rely primarily on a

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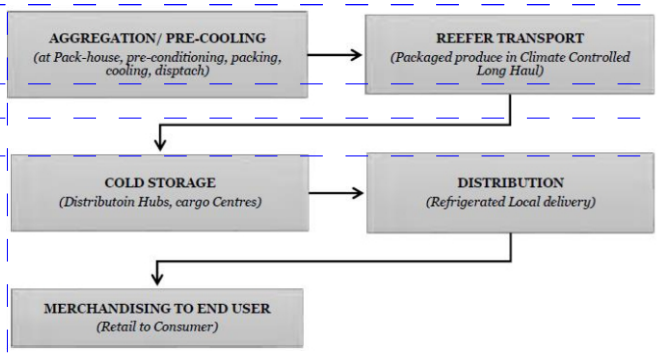

Fig1. Cold Supply Chain Infrastructure

supply based approach, using both cooling and packaging techniques; cold-chain system makes it possible to deliver the perishable produce in the right quantity and in the right form. Cold chain thereby empowers producers by expanding access to multiple and distant markets. Cold-chain is used for multiple product types (fresh fruits & vegetables, meats, dairy products, Pharmaceuticals, chemicals). In case of horticulture, cold-chain takes custody of the harvested produce and scientifically manages its delivery.

In the cold-chain, the characteristics of agricultural produce remains un-altered as prime activity of preconditioning at a pack-house does not transform the produce but safe-guards the value and makes it more marketable. The key benefit derived from cold-chain is empowering the direct linkage of farm-gate value with consumers. By enhancing the holding life and transportability of the produce, cold-chain allows the scope to reach and capture more markets.

Status of cold chain infrastructure

The estimated annual production of fruits is 90 million ton and vegetables are 160 million ton in India. Due to diverse agro climatic conditions and better availability of package of practices, the production is gradually rising. Although, there is a vast scope for increasing the production, the lack of cold storage and cold chain facilities are becoming major bottlenecks in tapping the potential. The cold storage facilities now available are mostly for a single commodity like potato, orange, apple, grapes, pomegranates, flowers, etc. which results in poor capacity utilization.

Infrastructure required and gap

As per the report of NCCD, 2015 the country has created 31.82 million tons of cold storage space. There is a current gap of 3.28 million tons in cold storage space (Bulk & Hub). Out of these, a total of 10.58 million tons in cold storage size were created in the last 7 years (*from 2007 to 2014*).

Under MOFPI: total 0.19 million tons capacity is created.

Under MIDH (NHM/HMNEH/NHB): total 10.39 million tons is created. Table2.Presents the component-wise status of infrastructure in India created under different schemes of various departments.

A survey conducted by NCCD in august 2015 "All India Cold-chain Infrastructure Capacity (Assessment of Status and Gaps)". As per the report of NCCD the integration of cold-chain does not exist due to a large gap in form of Pack-houses along with the associated capacity in transport. To establish supply chain links from farm-to-consumer, there is a need to focus on the development for creation of pack-houses and transport at village level (without the preconditioning centers, the produce cannot be readied for the cold-chain, and without transport,

Table 2. Existing cold chain infrastructure in India

	Infrastructure Component	Numbers	Capacity(MT)
1.	Modern Pack-House (Ph)	249	NA
2.	Cold Storages Hub (CH)	5367	5003
3.	Cold Storage Bulk (CS)		
4.	Ripening Chamber (RC)	812	NA
5.	Reefer Transport (T)	9000	6 to 12Tons
6.	Last Mile Transport (T)		<4 Tons
7.	Retail/Front End (FT)	1.968 million outlets	NA

Source: MOFPI (2012)

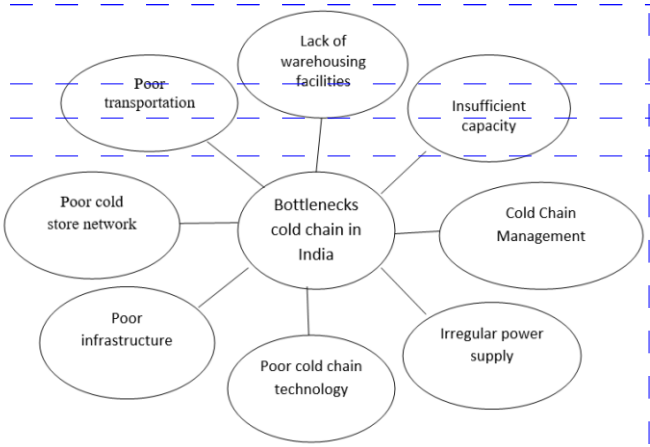

Fig2. Bottlenecks in the Cold Supply Chain

there are breaches in integrating the movement in the cold-chain). The key findings of the "All India Cold-chain Infrastructure Capacity *(Assessment of Status and Gaps)*" (AICIC-2015) are tabulated below-

There is a need of food processing units near to the pack-house (village level) locations, so that the handling waste generated at farm-gate can be processed into pickles, jams, etc.

Bottlenecks in the cold supply chain

Cold chain is now a growing sector in India. And this is a need of Horticulture sector to have an efficient cold chain infrastructure. It is very true that the country, which ranks second in F&V production in the world, needs a fully developed cold chain sector. However, the current scenario reveals that there is tremendous scope for the development of cold chain facilities.

The major bottlenecks which are found from the literature in the cold supply chain are lack of cold storage and warehousing facilities, inadequate capacities to serve the needs, irregular supply of power or shortage of power to run cold chain poor post-harvest cold chain technology, unavailability of cold storage in close proximity to farms, insufficient cold storage capacity, poor transportation infrastructure etc. Because of these issues in cold supply chain, this sector is suffering from maximum inefficiency and decline the quality of produce which affect the income of the farmers.

Around 95% of the cold storages are in private hands and because of high charges, an average Indian farmer is not able to avail the facilities of cold storage. There is a lack of ownership within the chain and all the players are concerned with their own revenue maximization with limited attention towards the overall profit of the chain. This lack of holistic view of supply chain is leading to post-harvest waste. In India, most of the northern and eastern regions are hilly terrain areas and are the major sources of F&V. The road connectivity for cold chain and network infrastructure in such areas is very poor, and hence it takes a long time to take the fresh fruits and vegetables to the market, resulting in the deterioration of the quality and condition of the produce and wastage. Lack of proper cold chain facilities results in greater wastage of the fresh produce. Prompt measures are required by the government and other stakeholders in India to improve the state of cold chains and to reduce the huge losses of fruits and vegetables and large amount of money.

Recommendations to overcome with the challenges

1. To balance variations in demand generated by local availability of fresh produce, a higher storage capacity at consumption centers may be targeted for buffer stocking and supply, within holding life limitations of each product type. In synergy, value is also recovered from produce which may be in excess or suffers handling damage by routing to food processing units. Modern pack-houses would benefit from attached micro small and medium scale food processing. In combination this will add to the opportunity at rural level.
2. It is important that along with pack-houses designed for cold-chain, an appropriate number of food processing units be developed. This will lead to greater value creation and higher output from rural India.
3. A **Multimodal cold-chain network** is a suitable physical manifestation of a nationwide market grid, for safe handling and transportation of perishable products from one place to another place, within or outside India. A multi-modal cold-chain network would necessarily require the use of scientific handling, including palletized handling of the produce/product. This

would lead to reduction in losses in the food supply chain by minimizing direct handling of the products, bring modern inventory managing systems, and intelligent tracking and traceability of food items in the supply chain.

4. This sector requires public private partnerships and govt. incentives to make this sector more attractive for investment by private players.
5. As existing warehouses and transportation system gets old and demand for perishable goods are continue to rise. Many Indian companies are working to modernize their cold chain set up to take on MNC's. There is emergence and acceptance of 3PL in Indian market and this will lead to transformation of these 3PLs to an integrated logistics services provided in near future.
6. Integrated cold chain solutions: ColdStar Logistics provides customized solutions for cold storage and refrigerated transportation across India for fresh and frozen commodities. Promoted by Tuscan Ventures, a logistics focused investment firm, their services include specialized refrigerated storage¸ warehousing¸ transportation¸ distribution and logistics.
7. *Comprehensive agriculture logistics solutions:* Private players like Star Agri that provide integrated post harvest management solutions have entered to fill the gaps.

Conclusion

The supply chain of F&V in India suggests that there is a need of cold chain infrastructure and it become a weak link in the supply chain of fruits and vegetables. Cold chain, which is the backbone of the F&V supply chain, is suffering from various bottlenecks, which results in the losses of produce and money. These losses can be avoided by providing proper cold chain facilities, such as cold storage, processing facilities and refrigerated transportation system, to the farmers in the local or regional markets and by attracting a large number of private agri-business players to set up infrastructural facilities. So, the government and private organizations have to put in the necessary efforts to improve the cold chain infrastructure in India to reduce the levels of wastage and poverty of farmers.

As the Indian economy is based on agriculture and as it has a huge potential to serve domestic and global markets through various value addition, the development of cold chain infrastructure will play a crucial role in reducing the losses and wastages, increasing farmer income, increasing the revenue from export, generating employment opportunities for the local people, and improving the livelihood of the farmers.

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Women and Climate Change in Uttarakhand

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Climate change affects health, food security, nutrition, production, and people's earnings. Mountainous regions are vulnerable to climate change and have shown above average warming in the 20th century. Uttarakhand state is also suffering from climate mediated risks. Traditionally women have many roles in agricultural production, as the procurers of water, cooking fuel, and other household resources. Women are not only well suited to find solutions to prevent further degradation and adapt to the changing climate but they also have a vested interest in doing so. There is an urgent need to focus on some strategies which could be helpful in facilitating farm women in coping up with climate change.

The natural resources of Uttarakhand provide life supporting, provisioning, regulating, and cultural 'eco-system' services to millions of locals as well as people living down stream. The livelihoods are almost totally based on natural resources like water, forest, agriculture, etc. About three-fourth of state's population is rural and virtually all depend on agriculture. Some of the reported climate change induced changes in the Uttarakhand Himalayas include: receding glaciers and upwardly moving snowline, depleting natural resources, erratic rainfall, irregular winter rains, advancing cropping seasons, fluctuations in the flowering behavior of plants, shifting of cultivation zones of apple (the zone has moved by 1000 m to 2000 m), reduction in snow in winter, rise in temperature, increasing intensity and frequency of flash floods, drying up of perennial streams, etc. Due to scarcity of food in the forest areas, many wild animals encroach into nearby residential areas and agricultural land for survival. Due to monkey, boars and leopards farmers of many villages have stopped cultivating vegetables and other crops. Climate change has also affected insect population in the region.

In hills, women play a major and crucial role in agricultural economy. They have rich and diversified knowledge as well as skill acquired through managing natural resources, livestock care, and agriculture-based livelihood and practice indigenous ways of maintaining good health. Women have contributed a great deal in maintaining and promoting agricultural genetic diversity. Due to natural calamities in the past years, women experienced extended workload and physical & mental exertion. The unpredictability in seasons and rainfall is affecting water availability, soil moisture, forest regeneration, and eventually food production. With limited access to resources and almost negligible participation in decision-making processes at household and community levels, women will be most seriously affected by reduced food and nutritional security. Women collect fuel and fodder from forest which along with other household responsibility put them under mental and physical exertions. Unusual events and extreme conditions enhanced pressure on them along with increasing risks and vulnerability. As compared to other parts of the country, women in hills are more vulnerable to nutritional problems. Various studies show that women perceive that work involved in cash crops is much greater compared to traditional crops, and this has increased women's work load many times over. Most of the women in hills suffer from lower back pain due to carrying heavy loads over long distances; they also suffer from various skin problems due to long exposure to sun. Due to the use of agrochemicals, women are exposed to several health hazards and gynecological infections. In case of rice transplantation, arthritis & intestinal and parasitic infections may take place due to long hours of work in mud and water. Increased temperature due to climate change is leading to an increase in weed infestation, and as weeding is essentially a women's task, it has added workload of women farmers. Since women's role and responsibilities are closely associated with natural resource management and farming, women will be the worst sufferer of climatic variabilities. Women's limited access and control

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over these resources increase their vulnerability to climate change and hinder their adaptation capacity.

Main challenges in Uttarakhand

- Land holdings are small and fragmented.
- Predominance of rain-fed agriculture.
- Soil erosion is a constant problem,
- Limitation of use of farm machinery in hill areas.
- Crop depredation by wildlife.
- Higher cost of production for agriculture in the hills.
- A significant migration is taking place, especially from the hill districts in search of better livelihood options, leaving their lands fallow and uncultivated.
- Inadequate value addition, storage and agro-processing units; non-availability of cold storages; and a lack of road and transportation are a big constraint to marketing.
- Low (and often unavailability of timely) inputs and access to last-mile connectivity for extension services in agriculture due to unavailability of agri-inputs on time.

Strategies for coping up with climate change

Women have proven to be leading the way towards more equitable and sustainable solutions to climate change. Across sectors, women's innovations and expertise have transformed lives and livelihoods, and increased climate resilience and overall well-being. Women are not only the passive victims of climate change but are also pro-active and agents of change for adaptation to and mitigation of abrupt climate change. Women utilize their experience and expertise to reduce the adverse impacts by adopting prudent strategies and are concerned about environmental issues. Some of the strategies are being practicizing and can be practiced by women for coping up with climate change:

- Saving energy and water at household level, improved livestock practices, promotion of sustainable agriculture, soil and water conservation in the fields and capacity building of farm women on the issues of climate change can be helpful in coping with the changing climate.
- Both men and women in Uttarakhand prioritized the strategy of household income diversification, i.e. wage labour in or nearby the village, sale of home made products, petty trade, as a means of guaranteeing livelihood security. Due to male out-migration, other strategies such as changing the roles and tasks within the household and in the calendar of work are prevailed in the state.
- Since women have a central role as users, conservers, knowledge holders and managers of agro-biodiversity, they highly prioritized and mainly adopted seed exchange.
- To guarantee food security in the face of climate change, both men and women prioritised the adoption of traditional crops and varieties with specific nutritional properties.
- For instance, women use creative ways to manage food and nutrition security in their households in lean months. Many of them plant cucurbits such as bottle gourd, pumpkin, okra etc. in their homesteads, catering to vegetable needs of the family since these are costlier in summers. Many women ensuring food security by processing fruits and vegetables and storing them for consumption later. Women in Uttarakhand also make different types of food items and store them for lean season. They also harvest weeds from field and forest and segregate them for consumption by human and some for cattle, while non-edible ones are composted.
- Hill communities are somehow adapting to these changes with the resources available to them. However, presently they lack information, services, technologies, assets, mobility, and the ability to make choices and decisions. In some areas of hills, farmers have already started taking adaptation measures which include replacing grain crops with vegetables. These crops give higher production than grain crops even in smaller areas with less resources and labor. This also provides them with much needed cash and nutrition. Production of off-season vegetables together with cash crops can be a strategy toward ensuring sustainable livelihood.
- The traditional varieties or Traditional Knowledge System (TKS) of millet when grown along with other modern crops provide for contingency when conditions are unfavorable.
- The crop at the same time has multiple usages as it

is used as vegetable and is also an important source of cattle feed. In hills, women manage the conservation of seeds. Their traditional knowledge on this aspect is very strong. This knowledge is crucial for adapting to climatic variability and environmental changes. In the Himalayan mountain region, majority of seed requirements of crops are met through traditional seed management and exchange systems, where the role of women is very important. Women are custodians of traditional knowledge related to seed conservation and maintain a diverse genetic pool of this valuable resource.

- The climatic conditions in hills are also favorable for growing medicinal plants that can fetch high prices and have a large and ready market.
- This is an irony of the hills that despite of plenty of water sources and adequate rainfall, there exists acute shortage of water not only for raising the crops but also for drinking. In order to cope with this situation, efforts must be made for developing rainwater conservation mechanism along with sprinklers and drip irrigation systems (especially for horticultural crops) for the efficient use of available water. There are several more options available which should be taken up vigorously in order to address the water crisis. These include the repair of *naula* (traditional wells), construction of infiltration tanks and recharging of natural water springs, and plantation of broad-leaved tree species that enhance water retention property of the soil and strengthen slope stability. Community water tanks should also be constructed to reduce drudgery of walking long distances to collect water.
- Women in high-risk zones choose leaves and stem of many plants available throughout the year for food. This becomes an important coping strategy to fight food shortage or famine. Many of these plants have been used in traditional medicine systems for their therapeutic effects. Their expertise and knowledge about non-agricultural food sources help in dealing with food and nutrition availability resulting due to fluctuating climate.
- Knowledge networks of women contribute immensely to tide over the adverse effect of the risk episodes. But these informal channels of dissemination of the knowledge are often not recorded in formal scientific discourses. Instead of ignoring the role of such informal networks, they can be used as channels for targeting climate adaptation policies and programmes. If women's groups become the focal points of knowledge and resource dissemination in situations such as crop failure due to flood or drought, there are fair chances that they will share these more openly. In addition, weather information needs to be provided according to local calendars, which are different from the Gregorian calendars.

Conclusion

Climate change represents a great threat to environment and development. The first step towards tackling the challenges of climate change is empowering women to safeguard the environment. Many technological alternatives are not available to cope with climate risks at hill, in such condition many women are finding creative ways to overcoming climate change risk. Strengthening the knowledge network and traditional knowledge of women, saving natural resources at household level and improved livestock practices could be very beneficial for climate change. Women act as a key for introducing strategy for climate change. There is a need to strengthen the knowledge of women on climate change so that they will act as a positive catalyst for the development of nation.

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Information on Protective Clothing for Sanitization Workers

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Coronavirus Disease 2019 (COVID -19) is an acute respiratory disease caused by a novel Coronavirus (SARS-CoV-2), which is spread by respiratory droplets, direct contact with cases, and infected surfaces/objects in the majority of cases. Though the virus can live for a long time on surfaces, chemical disinfectants such as sodium hypochlorite or phenolic disinfectants can quickly inactivate it, reducing the danger. Sanitation workers carry out the sanitization process in public places (where the risk of contamination is high), so protective clothing is an essential line of defence for workers in this occupation.

Using personal protective clothing & equipment reduces exposure and thus reduces risks to the sanitization worker. Following are the protective clothing to be used by the sanitization workers:

1. Coveralls: These are full length pants attached with long-sleeved shirts. Coveralls are closed at the neckline and wrists. These can be washable as well as disposable.

2. Waterproof spray suits: Coveralls can be splashed or soaked during sanitization with the chemicals, so waterproof spray suit can be used. It should be made of a material that can resist penetration of the chemicals. Rubber, neoprene, and polyvinyl chloride spray suits are usually suitable.

3. Apron: Chemical-resistant/waterproof aprons are used when repairing or cleaning spray equipment and when mixing or loading. Aprons offer excellent protection against spills and splashes of liquid formulations, but they are also useful when handling dry formulations. Aprons can be easily worn over other protective clothing. Apron extends from the neck to at least the knees. Some aprons have attached sleeves. Nitrile, butyl, and neoprene are suitable for protection from various hazardous chemicals. PVC and natural rubber aprons are also available.

4. Hats: The great risk of exposure to sanitization workers is through splash or drift, to avoid this wide-brimmed, rubber rain hat can be worn. Some spray suits have attached hoods which protect the head and neck area. Baseball caps, fabric hats, straw hats or hats with leather or cloth inner bands should not used because they will absorb and retain the chemicals.

5. Face shields: Chemicals used in sanitization process can be absorbed through the eyes and can cause eye injury. The face shield protects the face and eyes of sanitization worker from direct splashes of chemicals. Face shield is used when mixing and loading toxic chemicals for added protection.

6. Mask: Use of disposable triple layer mask is must for the sanitization workers. Masks are effective if worn according to instructions and properly fitted. Masks should be discarded and changed if they become physically damaged or soaked in chemical.

7. Gloves: Gloves are necessary when handling chemicals. Elbow length chemical-resistant gloves are used when handling all chemicals. The elbow length gloves protect the wrists and prevent chemicals from running down the sleeves into gloves. Glove materials include nitrile, butyl, neoprene, natural rubber (latex), polyethylene, polyvinylchloride (PVC) and barrier laminates like 4H® and Silver Shield® but nitrile, butyl, and neoprene offer good protection for both dry and liquid chemicals. Natural rubber is only effective for dry formulations. Gloves should not have any holes or leaks. Fingerless gloves should not be used.

8. Boots: Waterproof/ chemical-resistant, unlined knee-high boots of rubber or neoprene with thick soles can be worn when loading, mixing or using the chemicals for sanitization. Pant legs can be worn outside boots so the chemicals doesn't run into boots.

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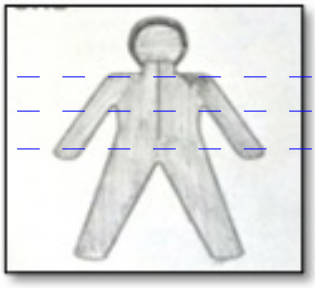
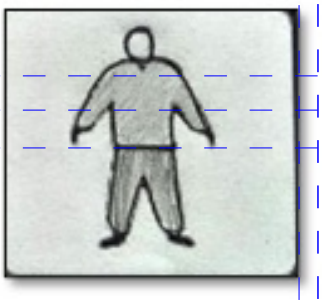
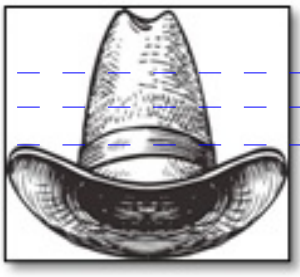


Coverall



Waterproof spray suits

Apron



Hat

Face Shield

Mask

Gloves

Boots

Boots made of leather or fabric should not be worn. Outside of boots should be washed after each use. Nitrile and butyl boots provides the best protection.

Washing of protective clothing

Sanitation personnel who use personal protective equipment decrease their exposure to contaminants. In several cases the protective clothing reduces the health hazards by lowering the chances of getting infected from viruses. However, to prevent the virus from spreading further, it is important to wash them safely after use. Used/dirty protective clothing should be washed because they can contain germs, viruses, bacteria, or traces of harmful chemicals, which can cause serious health issues. Washing of used protective clothing is the best way to keep toxic elements from spreading through regular wear. Here are some steps which should be followed during the laundering of the protective gear:

1. Collection of dirty and used clothes: Collect the used and contaminated protective clothing separately in a plastic carry bag. Keep used work clothing away from family members, pet and domestic animals.

2. Use of gloves for handling: Wear rubber gloves when handling the used clothing. Wash the gloves thoroughly before removing them, and do not use them for other household tasks.

3. Wash separately: Laundering is to be done separately from other clothing so that residues can be prevented from contaminating regular clothes.

4. Rinsing prior to washing: Soak in water, wash with running water using hose out-of-doors, or use a prewash cycle on the washing machine.

5. Use of hot water: Use of hot water maximizes the removal of residues from contaminated clothes.

6. Use of heavy-duty liquid detergent: Heavy-duty liquid detergents are not affected by water hardness and are very effective in removing oily residues and contaminations.

7. Multiple washings: Clothes should be washed more than once. If using machine, contaminated clothing may be effectively washed in one to three machine washings depending upon contamination present. Washer of the machine should be cleaned

after use, for that run the washing machine through a full cycle with detergent and no clothes to remove any residues of contamination. If hand washing is done, buckets and tubs should be cleaned properly with soapy water.

8. Dry on clothesline outside: Clothes should be line dried outdoors in sunlight as it is one of the good disinfectants.

Points to keep in mind

- Wear clean protective clothing each day.
- Keep contaminated clothing separate from your other clothing and from the family wash.
- Stop working and notify your supervisor if you notice a tear or other damage to your personal protective clothing. Replace damaged clothing immediately.
- Do not touch chemical contaminated clothing with your hands or any other bare skin.
- Do not store clean protective clothing with contaminated clothing, or in a dirty area.

Conclusion

The COVID-19 pandemic poses unprecedented risks, but use of PPE provides a unique opportunity to reduce the risks to the sanitation workers in their work environment. It is the most effective way to avoid direct chemical contact while also lowering the risk of contamination among employees. As a result, wearing protective clothing is an important method that provides sanitization employees with dual protection.

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Azolla : Important Feed Alternative for Livestock

Sanjay kumar[1], Alok Mishra[2], Preeti Bisht[3] and Abhishek Pathak[4]

India has largest livestock population in the world. Though it stands first in milk production and bovine population, average production still needs to be improved; it may be due to low plane of nutrition due to less availability of good quality fodder /feed. This has to be find alternate sources of good quality unconventional feed/fodder for efficient livestock production. The search for alternative feed/ fodder to different species of animals, a wonderful plant called Azolla, which holds the promise of providing a sustainable feed for livestock. Azolla is very rich in proteins, essential amino acids, vitamins, growth promoter and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium. Dry weight basis, it contains 25 - 35 percent protein, 10 - 15 percent minerals and 7 - 10 percent of amino acids, bio-active substances and bio-polymers. The carbohydrate and fat content of azolla is very low. Its nutrient composition makes it a highly efficient and effective feed for livestock. Livestock easily digest it, owing to its high protein and low lignin content. Azolla can be used as an ideal feed for cattle, fish, pigs and poultry, and also as a bio-fertilizer for wetland paddy. It is popular and cultivated widely in many countries. Thus, it has future as a potential feed ingredient for various types of animals.

Azolla is an aquatic fern consisting of a short, branched, floating stem, bearing roots ,which hang down in the water, also known as mosquito fern, duckweed fern, fairy moss, water fern. In India, there is a substantial decline in availability of fodder due to the area under forest and grasslands are decreasing day by day. The shortage of fodder is therefore compensated with commercial feed, resulting in increased costs in meat, egg and milk production. Moreover, as commercial feed is mixed with urea and other artificial milk boaster, it has a negative effect on the quality of milk and the health of the livestock. The search of alternatives to concentrates led us to a wonderful plant Azolla, which holds the promise of promoting a sustainable feed for livestock. Azolla hosts symbiotic blue green algae,anabaena which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla, in turn; provides the carbon source and favorable environment for the growth and development of the algae. This symbiotic relationship makes azolla a wonderful plant with high protein content. Azolla is easy to cultivate and can be used as an ideal feed for cattle, poultry, pigs and fish, and also can be use as a bio- fertilizer for wet land paddy. It is popular and cultivated widely in other countries also like China, Vietnam and Philippines.

Azolla has enormous potential as a livestock feed due to

Azolla can be fed to livestock either in a fresh or dried form. It can be given directly or mixed with concentrates to cattle, poultry, sheep, goats, pigs and rabbits. It takes a few days for the animals to get used to the taste of azolla, therefore it is better to feed along with the concentrates in the initial stages. It has ability to proliferate without inorganic nitrogen fertilization. It has high rate of growth in water without the need to displace existing crops or natural ecological systems. It is very rich in proteins, essential amino acids, vitamins (vitamin A, vitamin B12 and Beta- Carotene), growth promoter intermediaries and minerals like calcium, phosphorous, potassium, ferrous, copper, magnesium etc. On the dry weight basis, it contains 25 - 35 percent protein, 10 - 15 percent minerals and 7 - 10 percent of amino acids, bio-active substances and bio-polymers. The carbohydrate and fat content of azolla is very low. Its nutrient composition makes it a highly efficient and effective for livestock. Livestock easily digest it, owing to its high protein and low lignin content, and they quickly grow accustomed to it. Moreover it is easy and economic to grow.

Cultivation of azolla

1) Small ponds of 320 meter size should be made in low land field.
2) Add sufficient water and 10-15 cm standing water should be there in the ponds.
3) Culture of green Azolla 50-200 g/sqm along with

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single super phosphate (20 kg/ha) as a phosphorus source should be mixed and release into the pond containing water level of 15 cm.

4) Rapid multiplication of Azolla plants forms a green color mat just like carpet in the ponds within 14-21 days.
5) This green mat then can be harvested and released in the rice field or can be used after through washing and drying as an animal feed.
6) This Azolla can be used as a bio-fertilizer by converting it into compost.
7) During hot season Azolla can be harvested at regular interval of 21 days.
8) However, during winter season growth rate of Azolla plant slow down due to moisture stress and low temperature. Therefore, Azolla should be harvested after 30 days of interval during this season.

Benefits of azolla

There are numerous benefits of Azolla which are useful to the aquatic environment in many ways. Some of the benefits are as:

1) Low input cost.
2) This is easy to grow in wild and also can grow under controlled condition at farm.
3) Within short period of time it can easily be produced a large quantity as green manure required in both Kharif as well as Rabi season.
4) It can fix atmospheric nitrogen and CO_2 to form carbohydrates and ammonia, respectively, and after decomposition it adds available nitrogen for crop uptake and organic carbon content to the soil.
5) The oxygen released due to oxygenic photosynthesis, helps the respiration of root system of the crops as well as other soil microorganisms.
6) It makes Zn, Fe and Mn to soluble form and incorporates to the crops such as paddy.
7) Azolla suppresses tender weeds such as Chara and Nitella (stonewort) in a paddy field.
8) Azolla releases plant growth regulators and vitamins which enhance the growth of the rice plant.
9) A potential bio-fertilizer Azolla can be substituted for chemical nitrogenous fertilizers to a certain extent (20 kg/ha) and it increases the crop yield and quality and thus reduced cost of production.
10) It increases the utilization efficiency of chemical fertilizers, if any used.
11) It reduces evaporation rate from the irrigated rice field.
12) It is a food source for waterfowl, fish, shrimp, insects, worms, snails, crustaceans etc. and provides habitat to them.
13) Mats of Azolla can actually discourage blue-green algal blooms. They restrict the penetration of sunlight into the water, which is essential for algal growth and take up nutrients from the water, limiting the availability of this food source for the algae.

Conclusion

Azolla can be used as an ideal feed for cattle, fish, pigs and poultry, and also as a bio-fertilizer for wetland paddy. It is popular and cultivated widely in other countries, but has yet to be taken up in India, in a big way. Azolla has a potential as a promising and economical feed for different species of animals. Azolla has been used for centuries in agriculture field. Available literature indicates that Azolla is an economic and efficient feed supplement for different species of animals, containing substantial amounts of protein, amino acids, vitamins and minerals which significantly reduce the cost of feeding. Thus, Azolla has future as a potential feed ingredient for various types of animals.

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Nutritional Strategies to Mitigate Cold Stress in Poultry

Anshu Rahal[1], Mohit Bharadwaj[2] and Yanshi[3]

Cold stress is common problem in poultry in winters affecting hatchability, feed consumption, egg and meat production, thereby making birds more susceptible to infections and diseases. Nutritional management from the starting days can help in mitigating the side effects of cold and help in maintaining profit of farmers.

The winter season has approached and has started created havoc for human beings and livestock and poultry. The chilling wind and low temperature makes the life miserable if proper timely management is not practiced. The young flock of poultry are most susceptible to winter stress so easily become victim of infectious diseases like ascites. If following nutritional strategies are followed, cold stress effects can be mitigated and loss of production in form of meat and egg can be prevented.

1. In winter, days are shorter but there is daily requirement of sixteen hours of light for egg production. Since more of energy resources are needed to keep body warm, egg production falls. So slightly the energy supplements like soybean oil needs to be included in the ration of birds. Poultry makes use of food for two main purposes i.e., firstly as an energy source for body temperature maintenance and for normal physiological activities and secondly as building material for bone, feather, flesh, egg development etc. Slight increase in feed intake is noted in winters. Calories consumption (ME) of bird/day varies with changes in ambient temperature. When more feed is consumed by bird, along with energy, other nutrients like minerals are also consumed in more amounts which are actually not needed, becoming a waste. During cold season, to avoid this wastage energy rich sources like oil/fat needs to be added to the diet or level of other nutrients may be reduced thereby keeping the energy at same level.
2. Grit should be included in the diet throughout winter season.
3. Broiler house temperature should be 95º F in first week, then decrease temperature by 5 º F every week till 80 º F from 2nd to 4th week. As chicks are more susceptible to winter stress, for first 10 days provide tetracycline 1g/litre water along with vimeral (vitamin supplement)@5ml/100 birds.
4. The poultry houses window/sides need to be covered with thick woolen/jute bags so that cold air current cannot enter and proper temperature needs to be maintained using heaters and bulbs. Proper ventilation should be maintained so that ammonia does not get accumulated in the poultry shed.
5. In winter water consumption reduces of birds which affect feed consumption, thereby reducing production. Always provide fresh, clean water which may be made lukewarm by adding hot water. Vaccines/antistress vitamins/medicines needs to be given through drinking water .Jaggery @20g/litre of water may be added to keep digestive system in proper condition. If water gets collected nearby poultry house bleaching powder or limestone powder should be sprayed so that diseases can be prevented
6. Increase number of feeders and make feed available whole day. For proper growth of broilers about 23% protein and 3400 Kcal of ME should be present per Kg of ration.
7. Herbal feed additives like aloe vera, amla, spices etc can be added in ration of poultry along with increased amount of vitamin E to withstand stress conditions.

Conclusion

If above points are taken in consideration, feed conversion ratio, egg production, growth and hatchability can be maintained in cold season in poultry.

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Repeat Breeding in Bovines: Major Cause of Infertility

Mridula Sharma[1], Chandni Bahuguna[2] and Damini Arya[3]

Repeat breeding is one of the main causes of female infertility in the animal reproduction. Animal that fails to conceive even after 3 or more number of successful services are repeat breeders. Main causes of repeat breeding are fertilization failure and early embryonic mortality, which might be due to congenital, genetic or acquired defect, infectious cause or endocrine dysfunction and most commonly managemental and nutritional deficiencies. This may be either from male aspect or female aspect. Male aspect is related to the defected semen while female aspect related to defected ova, uterine environment, hormones, nutrition, stress, etc. Incidences of repeat breeding is continuously increasing (ranging from 18-20% in cattle and 8-9% in buffalo in India), which causes economic loss to the dairy herd by reducing calving, lactation and increased expense at management. Treatment and management of the causes are done accordingly to bring animal in productivity.

Animals that fail to conceive even after 3 or more number of services but has normal estrous cycle and estrus period with no abnormality in the vaginal discharge, no palpable reproductive disease and has calved at least once before and is less than 10 yrs of age are known as repeat breeders. More incidence is seen in winter months as compared to spring & summer months. Increased incidences are seen in pure bred and less in cross - bred cattle. Older cows have high incidences of repeat breeding as compared to heifers calved for the first time.

Causes of repeat breeding

- Fertilization failure
- Early embryonic mortality

Fertilization failure

Fertilization failure accounts for about 15 % of reproductive wastage in normal cows. In repeat breeder cows, the fertilization failure may be higher around 28 – 44 %. Main factors affecting fertilization failure are poor quality of semen including low sperm concentration, poor sperm motility and semen collection from older bull or suffering from testicular degeneration, cryptorchidism and orchitis. Improper handling of semen and improper AI are responsible for repeat breeding. Impaired function of hypothalamus, pituitary and ovarian activity along with follicular/ luteal cyst, anovulatory heat, delayed ovulation, failure of collection of ova by fimbriae, defects in ovum, inflammatory conditions and anatomical defects are the factors of female leading to repeat breeding.

Early embryonic mortality

It accounts for 25 % of reproductive wastage. Major portion occurs between days 8 and 16 after breeding. Cow will return to estrus at normal interval, if embryo deaths occurs before MRP. Various causes like nutrition, age of dam, ambient temperature, hormonal imbalance, stress like pain & long transportation results in embryonic death. Progesterone deficiency, uterine infection, embryonic factors like chromosomal abnormality and genetic factors makes animal repeat breeder. Infection is responsible for 2 – 8% of the repeat breeder cases.

Classification

1. Congenital/ genetic / anatomical defects of genital tract
2. Congenital/ genetic/ acquired defect of ova/ spermatozoa/ early zygote
3. Infectious/ traumatic inflammatory processes
4. Endocrine dysfunctions
5. Managerial & nutritional deficiencies

Genetic or congenital anatomical defects of the genital tract

It causes failure in fertilization by preventing union of sperm and ova. In case of bilateral defects complete sterility is observed. e.g.: ovarian hypoplasia/ aplasia, segmental aplasia of oviduct (6 – 15%), uterus, cervix, vagina, hermaphroditism, white heifer diseases. Lack of endometrium also results in embryonic death. These conditions can be diagnosed by tubal patency test: PSP dye test, air/ gas

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insufflation, hysterosalpingography and laproscopy. The only treatment for sterile animals is culling while infertile animal are treated likewise.

Genetic, congenital or acquired defects of the ova, spermatozoa or early zygote

Inbreeding (purebred or closely bred lines) leads to expression of more recessive gene in the animal. Lowered fertility of older cow is due to defective ova and breeding cows at the end of estrus leads to aged ova which when fertilized with aged spermatozoa (10%) results in early embryonic death. Defects in sperm (atypical basic nuclear protein), testicular hypoplasia and degeneration gives abnormal, infertile or sterile semen. Incompatibility / possible immunological factors between spermatozoa & zygote & dam and chromosomal defects also leads to early embryonic death. Acquired defects like ovario-bursal adhesions, hydrosalpinx etc. prevents fertilization.

Infectious or traumatic inflammatory processes affecting the genital organs

Unilateral/ bilateral obstruction of genital tract results in failure of fertilization. Sub clinical infection is detrimental to sperm cells thus preventing fertilization. Infectious venereal disease like trichomoniasis (Tr. fetus), vibriosis (V. fetus), brucellosis (Br. abortus), mycoplasma causes early embryonic death and endometritis. Infection also spread through AI - C. pyogenes, Ps. aeroginosa, Streptococci, Staphylococci, E. coli; these bacteria are present in seminal vesicle of bull. Antibiotic treatment of semen can be done to eliminate infection that may affect females.

Endocrine dysfunction

Endocrine dysfunction dealing with the hormonal imbalance results in anovulation (2 -16 % of repeat breeder cow), failure of release of LH, cystic ovaries, weak heat which leads to failure in fertilization. Delayed ovulation, progesterone deficiency, hypofunctional CL, excess of estrogen, results in early embryonic death due to aged ova. Administration of GnRH or LH at the time of AI increases the ovulation. Progesterone administration 3- 5 days after service and again 16 - 17 days of AI improves conception rate. Administration of 5000 IU hCG about 4 days after breeding increases the size of CL that in turn increases progesterone. GPG protocol treats cystic condition. In delayed ovulation and anovulatory heat GnRH @ 2.5ml followed by PG after 9 -10 days and fixed AI at 72 and 96hrs gives conception.

Managerial deficiencies including nutritional deficiencies

Managemental defect in AI is basic reason which includes improper extension, freezing & storing of fertile semen, improper thawing of frozen semen, insemination not done within several minutes after thawing and improper insemination techniques. Malnutrition is one of the major causes resulting in negative energy balance in animal that includes deficiency of glucose, insulin, IGF, protein, cholesterol, vitamin A, vitamin E and selenium. Management can be improved by frequent heat check & regulated insemination. AI should be done at proper time of estrum. Proper TDN intake, I, Cu, Mg supplement should be given in feed to bring animal in positive energy balance.

Diagnosis

Proper reproductive history and repeated gynecological examination of the cow should be done. Examination of the normal structure of the reproductive organs and nature of discharge gives us the information about health of the animal. Ultrasonographic examination for any abnormality that can't be detected by hands. Recently tubal patency tests are also being used such as PSP dye test, air or gas insufflation, hysterosalpingography and laparoscopy.

Conclusion

More incidences of repeat breeder cases are seen in last 15yrs. Treatment or handling of such cases should be based on experience, skill, knowledge and thoroughness of diagnostic procedures to arrive at cause of the problem (may be single or in combination of causes). Cows having history of repeat breeding for several years must be culled to maintain the productivity of herd and proper managemental practices should be followed.

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Bovine Theileriosis

N.S. Jadon[1], Rashmi Saini[2] and Arun Kumar[3]

Bovine theileriosis is a tick-borne disease, caused by Theileria annulata. The vector ticks are of the genus Hyalomma. The most prominent symptoms are fever and lymph node enlargement. But there is a wide range of clinical manifestations, especially in enzootic areas. An efficient treatment with parvaquone, then buparvaquone became available in many countries from the mid-1990s. Animals native to endemic areas appear more tolerant to the disease, buffalos especially, appear less susceptible. Body temperature is regularly higher than in any other cattle disease. Fever from 41 to 42°C is common in acute stages. Later on (day 5 to day 10 from the clinical onset), temperature will lower to a normal range (38.0–39.5°C), but the disease will continue to progress, despite a possible apparent clinical improvement (appetite comes back). Afterwards, there is a downfall stage, with hypothermia (37 to 38°C), anemia, jaundice, and heart failure. Such animals rarely recover, even with intensive treatment.

Tropical bovine theileriosis in India caused by a protozoan parasite, *Theileria annulata* is posing serious clinical and economic problems to our cross-bred cattle and young indigenous calves. Our local adult zebu animals are less susceptible but act as carriers of this and serological surveys, Theileria infection has been detected among 30 to 80 per cent of apparently healthy cross-bred cattle in different states of India. All age groups of cattle are susceptible but young bovine calves of less than 3 months are highly susceptible. In a serological investigation, 10.9 per cent serum samples out of 407 sera from buffaloes were found positive for antibodies against *T. annulata*. There is a considerable seasonal variation with respect to the occurrence of clinical cases of theileriosis in our country. Majority of these cases occur during summer and rainy seasons i.e. from May to October, though cases keep on occurring throughout the year. This probably may be due to abundance of active vector ticks during this period. Theileriosis is usually transmitted by the ticks of genus *Hyalomma*. Mortality is often low as most of our cattle population runs a low grade theilerial infection due to their constant exposure Clinical cases of mixed haemotropic infection on account of *Theileria, Babesia* and *Anaplasma* spp. occur quit Frequently in the field.

Clinical signs and diagnosis

Incubation period, severity and course of the disease depend on several factors including include enlargement of regional lymph nodes i.e. prescapular, parotid, prefemoral etc. along with high rise of body temperature (40.5'C to 41.5"C), haemorrhages on conjunctivae and increased heart and respiration rates. In later stages, there is extreme weakness, exhaustion and animals become highly anaemic with pale conjunctivae. In some clinically affected animals, haemorhagic spots on perineal region and urticarial like skin lesions have been observed. Drop in milk yield and abortion are also noticed in the affected animals.

Clinical cases of theileriosis can be diagnosed tentatively 'by recording various symptoms as described earlier but confirmation of such cases require demonstration of parasites or piroplasms in erythrocytes and or Koch's blue bodies in lymphocytes. Biopsy smears of lymph nodes also show Koch's blue bodies. Characteristic postmortem changes, i.e. presence of punched ulcers in the abomasum can easily be observed in clinical cases of the disease. Indirect fluorescent antibody test is quite useful diagnosing Complement fixation, Capillary agglutination and conglutinating complement adsorption test have also been found fairly accurate in detecting latent cases of Theileria infection.

Therapy: Buparvaquone (Butalex) now being marketed by M/S Cadilla Laboratories Pvt. Ltd. in India is the most specific and effective drug for treatment of bovine tropical theileriosis. Since clinical cases suffer from anaemia, haematinics, such as B- Complex and Iron preparations should

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also be administered. A few other drug preparations like Clexon, tetracyclines have also been found efficacious.

Prevention

(I) Immunisation: A recently introduced tissue culture vaccine 'Rakshavac-T' marketed by Indian Immunological is indicated for cattle against tropical theileriosis. It is contraindicated in advanced stage of pregnancy and below three months of age. A few of the vaccinated animals may develop pyrexia and prescapular lymph node any time from day 8 to 20 post vaccination. As cases of clinical theileriosis occur mostly in young animals, efforts are being made at different Veterinary Institutes to develop a suitable vaccine which can be administered to animals of all the age groups particularly young ones.

(ii) Infection and treatment method: Different experimental studies have shown that the treatment of calves with tetracyclines or clexon or buparvaquone during and after inoculation of infected ground up tick stabilate or fecdiax of *T. annulata* infected ticks on animals suppressed flaring up of the disease. This may provide adequate prophylaxis against bovine tropical theileriosis as large number of doses from Theileria infected ticks can be produced and used in the field easily.

(iii) Insecticide Spray: Since ticks act as the vectors of the disease, spraying of animals and animal sheds with some effective insect ides like malathion, diazinon, asuntol etc. would be useful in minimising the tick population but in a country like ours where the management of the anima villages and other places is not on scientific lines this method appears to be less practicable.

Conclusion

Buparvaquone, halofuginone and tetracycline and butalex and oxytetracycline have all shown to be effective. Tick control should be considered, but resistance to parasiticide products may be increasing. There are various options for controlling ticks of domestic animals,including: topical application of parasiticidal chemicals in dip baths or spray races or pour-on formulations, spraying parasiticides on walls of cattle pens, and rendering the walls of cattle pens smooth with mortar to stop ticks molting there. Selection of cattle for good ability to acquire immune resistance to ticks is potentially effective. Endemic stability is a state where animals are affected at a low level or not as susceptible to the disease, and this may be encouraged in endemic areas. Vaccination is available and should be performed in breeds that are susceptible to infection.

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Biological Control of Ticks in Livestock

Pramod Prabhakar[1] and M.K. Bharti[2]

Biological control means 'control of an organism by using another living organism'. Classical biological control covers the recognition, assessment and introduction of a natural enemy from elsewhere, the maintenance of indigenous usual enemies and the expansion of the biocontrol agents. Biocontrol agents are generally slower-acting, but cause longer-lasting biotic suppression of a specific pest population. Ticks are important vectors of disease-causing pathogens of humans, wildlife, and livestock. Reducing tick abundance is an important but elusive goal.

Chemical pesticides applied to habitats occupied by ticks can be effective but appear to have significant negative effects on non target organisms. Reducing tick abundance is likely to remain the most effective method for preventing tick-borne diseases. Several methods of bio-control of ticks, including parasitoids and some bird predators, have been shown to reduce tick numbers in some situations. Perhaps the most promising method of bio-control is the targeted use of fungal pathogens, which has been shown to reduce tick numbers both directly (through mortality) and indirectly (through reductions in fitness).

These preliminary successes demonstrate the importance and potential of rigorous research into novel and existing methods of biological control of ticks. The most promising alternatives to chemical pesticides are biological control (bio-control) agents, which are species that consume target pest organisms via predation, herbivores, or parasitism. Bio-control agents typically are nontoxic to humans and to non target wildlife (for a few exceptions, see below). Moreover, bio-control agents are expected to coevolve with their target organisms, reducing the likelihood that resistance will evolve. Biological control of ticks or mites means controlling them with natural organisms that are their natural enemies.

There are three major types or organisms that are natural enemies of those ticks and mites that affect livestock

- Predators: They just eat the ticks; either those still attached to the host, or engorged females that have dropped to the ground: mainly birds, ants and a few mite species.
- Parasitoids: These are wasps that deposit their eggs on ticks. The larvae of the wasps feed on the tissues of the ticks that are ultimately killed. They can be considered as "parasites" of the ticks.
- Pathogens: Mainly bacteria, fungi and nematodes (roundworms) that infect and kill the ticks or mites or their larvae. They can be considered as "diseases" of the parasites. So far there are no biological control methods against ticks and mites of dogs and cats.

Why biological control is preferred

Pest biocontrol is becoming one of the most hopeful replacements to chemical pesticides.

- This technique is used:

To minimize the chemical residues on our planet
To minimize the growing problem of arthropod resistance to pesticides

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To balance rising prices of new chemical pesticides
To create friendly environment(chemical free)
Due to longer effect of this techniques compared to other methods
To overcome the drawback of broad spectrum insecticide

Significance of ticks

Ticks are economically the most important pests of cattle and other domestic species in tropical and subtropical countries. PathogensWhy it should be preferred for the control of Ticks? Fungi are the most reliable source of tick control due to the following reasons.

1. The ability of entomic-pathogenic fungi to penetrate the cuticle of arthropods
2. The ability of a strain to kill several stages of ticks.
3. The relatively specific virulence of a single strain to one or agents.

Mechanism of action

EPNs penetrate engorged female B. annulatus ticks almost solely via the anus or genital pore. Heterorhabditid nematodes killed engorged B. annulatus females in Petri dishes after less than 2.5 h of exposure, whereas steinernematid nematodes needed more than 4 h to penetrate into ticks. The injection of a single heterorhabditid nematode into a tick can cause mortality.

Parasitoids

Most parasitoids used in the biological control of insect pests of plants belong to the order Hymenoptera. Only a few species of hymenopteran parasites are known to affect ticks. It has been described that two species of chalcidoid wasps collected from ticks in Texas. These are now both included in the genus Ixodiphagus of the family Encyrtidae, which includes seven species, all tick parasites. The most widespread species is I. hookeri which has been recorded from Asia, Africa, North America and Europe. The EPNs are known to be pathogenic to over 3000 insect species, whereas each strain may often be relatively specific to a small group of hosts and thus their effects on most beneficial insects have been found to be negligible.

What the end result is?

The development of anti-tick biological control agents (BCAs) is still in its infancy. Furthermore, the various steps required for commercialization of these products, including adaptation by companies (production, storage and delivery) and education of consumers (storage, application and evaluation of results), are still in the future. Nevertheless, we believe that the need to develop alternative control methods will yield useful results.

The fact that some BCAs and particular strains are far more specific in their selection of target pests than are acaricides and that many strains are effective only under specific ecological conditions, provide considerable advantages over pesticides, because harmful ecological effects are minimized. Partial or total replacement of chemical acaricides with extra use of tick pathogens and/or parasitoids would require considerable changes in the techniques of producers and suppliers. Biological control of plant pests, by means of parasitoids, predatory mites, viruses, B. thuringiensis, bugs, beetles, and others, has had several striking successes.

These include the use of several enemies/ pathogens simultaneously or in a pre-determined order. However, only about 5% of all pest problems are treated with biological control methods and many problems have to be solved in order to increase their use. Relatively few studies have been performed on

the existence of promising natural enemies of ticks, or on their use against ticks in most parts of the world. Collaboration between biocontrol experts who have experience in managing plant pests and tick experts could lead to valuable developments in tick biocontrol. In India, there are nature gifted biological agents, which can be used for the control of ticks. These include sparrows, crows, chickens and parrots. But for this we have to move towards the nature, so that balance of nature cannot be disturbed. Similarly, we can purchase birds like oxpecker, can develop anti-tick bacterial and fungal sources. A lot of research is still needed until reliable products based on these nematodes become commercially available for the control of ticks or mites of veterinary importance.

Ticks have numerous natural enemies, but only a few species have been evaluated as tick biocontrol agents (BCAs). Most predators of ticks are generalists, with a limited potential for tick management. Biological control is likely to play a substantial role in future IPM programmes for ticks because of the diversity of taxa that show high potential as tick BCAs.

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Winter Management at Poultry Farm

Shive Kumar[1], Sonali D. Chandankar[2], Roshan M. Sarode[3] and Megha Verma[4]

Winter season has great impact on poultry production. During winter season when temperature goes down below 55° F, various problems like reduction in water consumption, poor FCR in broiler, decreased weight gain, reduction in egg production, reduction in fertility and hatchability breeder stocks. To get the maximum profit out of the poultry farming in winter, the birds should be free from all types of stress. Consequently, the management of poultry amid winter is an essential toward enhance poultry production.

Orientation of a poultry building with respect to wind and sun consequently influence temperature. The poultry house should be designed in a way that maximum sun light enters the shed during day time. The insulation is the important thing, which provides an opportunity of controlling cold air inside the poultry sheds. The walls give better insulation than open side house having curtains. It should be insure that there are no holes, cracks and breakage in the walls and roof from where air may enter.

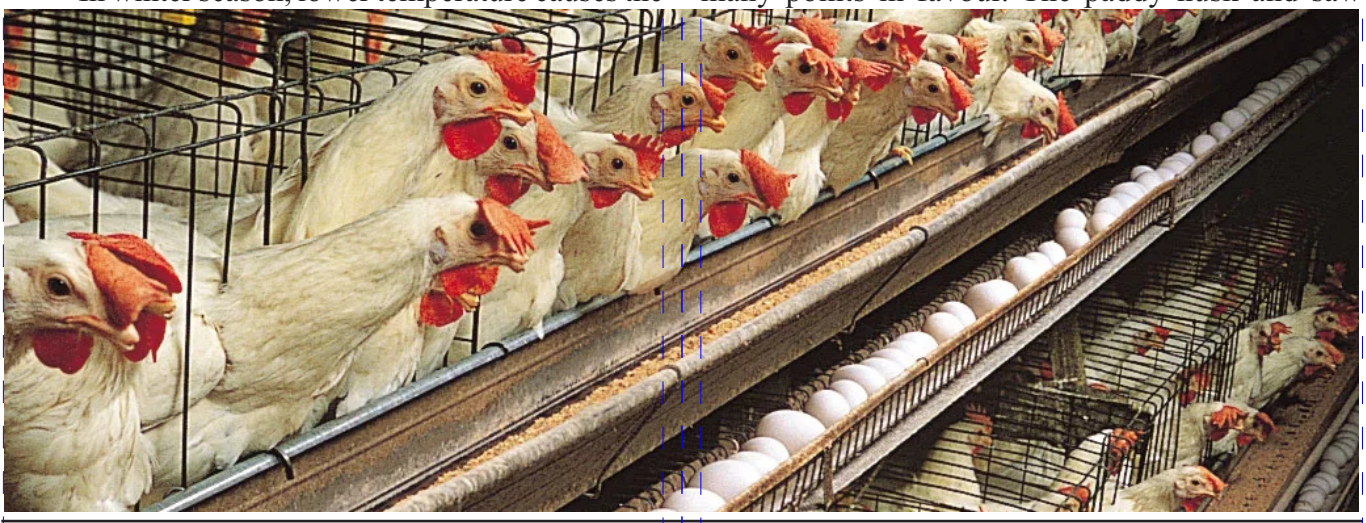
Birds should be protected from chilled winds, for this gunny bags should be hanged at the place from where the cold air enters. These gunny bags should be hanged down as soon as sunlight goes in the evening till the arrival of sunlight next morning. In winter, the arc of the sun's visible path is shortened, an east west alignment of a rectangular house provides a maximum gain of solar energy in winter.

Ventilation management

In winter season, lower temperature causes the chilled air entering the house to fall very quickly to the floor due to the increased weight of moisture instead of mixing with warmer air in the house and falling more slowly. If there is confined ventilation it causes smelling salts develop which causes respiratory issues. It is important to get the air and floor temperatures correct, as chicks don't have the ability to regulate their own body temperature until they are 12-14 days old. So, they need plenty of fresh air circulating around the house. The sliding windows are valuable as they can be opened amid day and shut amid night. There should also be arrangement of exhaust fans to remove impure air and ammonia. For proper insulation and sealing of the poultry shed should be needed.

Litter management

A mixture of litter material can also be used. It is advisable that litters should be organic in nature. Fresh litter should be used with rearing pullets and new batch of birds on clean litter has many points in favour. The paddy husk and saw



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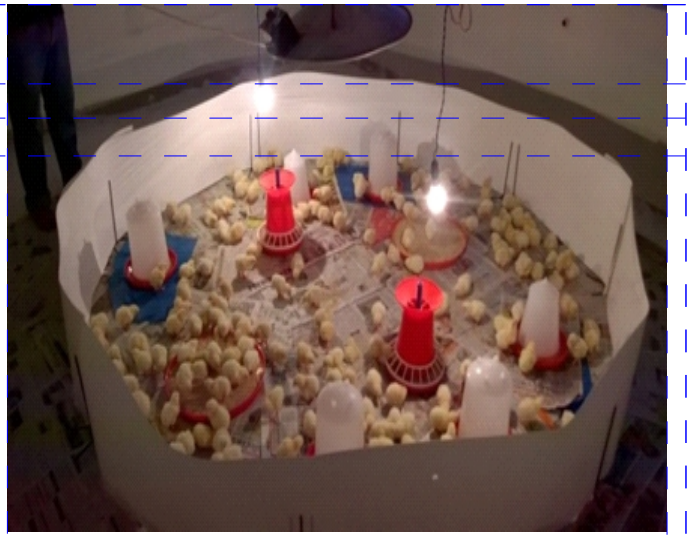

dust etc, should be spread on floor around 4- 6 inches of litter is required in houses amid winter. It gives comfort to the birds. A decent quality of litter serve as an insulator in keeping up uniform temperature, likewise prevent dampness and give advantage in drying. It weakens faecal material in this way diminishing contact in the middle of feathered creatures and fertiliser. The litter gives warmth to the birds during winter.

Feed management

For Broiler

It has been tentatively demonstrated that for legitimate development amid summer finisher diet containing 19.5% protein and 3200 Kcal ME/kg eating regimen is required. While in winter 19.5 % protein and 3300 Kcal/ kg ME is required. Raising the amino acids levels, even above recommended levels, will support better FCR, higher growth rates and higher breast meat yields. The optimum space requirement in broiler is 1.25 ft^2/ bird..

For layers

The protein and energy requirement in layers is 18% and 2650 Kcal ME/ kg respectively. The average feed consumption in chicken is 6.5 g/ chick in first week, 65 g/ grower bird in 11 week and 110 gm/ layer in 24 weeks. The average floor space required for growing birds female and male are 1.9 ft^2 and 2.1 ft^2 respectively.

At 7-8 feet above the ground level light should be provided in poultry sheds and must be hanged from ceiling. The interval between two bulbs is 10 feet, if incandescent bulbs are used and in case of fluorescent lights (tube lights) the distance between two lights should be 15 feet for proper lightning in poultry sheds.

Water management

The waterer space for per chicks should be between 0.60 - 1.00 inches. The average water consumption per 1000 chicks is 8.3 lit/ day and after day by day it should be increased according to requirement. During growing period waterer space should be 0.85 inches/bird. The water consumption requirement for 1.33 kg body weight female in 22 weeks is 11.5 % of their live body weight.

Brooding management

Prepare the house completely with all essential requirements and adjust the brooder stoves 24 hours before the arrival of chicks. Check and clean all the equipments once. Adjust the temperature to 95°F (35°C) at the edge of the brooder 2 inches (5cm) above the litter. Lower the temperature by 5°F (2.8°C) each week up to 4-5 weeks until it reaches 70°F.

Brooder guard

- Properly sterilised guards should be used during brooding.
- Height of Guard should be approximately 16 - 18 inches.
- Brooder guards will be used to keep the chicks near the source of heat.
- Brooder guards helps to prevent the chilling and piling

Tips for winter management in poultry

1. Provide good quality litter material (rice husk or wood powder).
2. Round brooder is important to avoid corners. Corners are the place, where birds gathered and chance of mortality increases.
3. Brooding equipment must be cleaned with good quality disinfectants including water pipes before receiving chicks.
4. The main thing is that if you are giving heat through electrical equipment, then you should

have backup by alternative ways in case of power off.

5. Give proper lights to all birds and light must be same and proper in all areas.
6. Double curtains from sides one of joot and of strong polythene to avoid direct cold air entry in poultry farm.
7. Ventilation is required during the brooding period to maintain temperatures at the targeted level to allow sufficient air exchange to prevent the accumulation of harmful gases such as carbon monoxide, carbon dioxide and ammonia.
8. Add dry litter material to minimise the extra moisture in poultry farm..
9. Experience and trained person should be appointed in the poultry farm to keep on eye on temperature meter after every hour especially in first 7 days. In first seven day best care should be taken of chicks for proper growth.
10. The use of stirring fans will enhance air quality and uniformity of temperature and relative humidity.
11. Light is an important factor during brooding that should not be ignored. Light intensity should be given 20 lux for better results in brooding time.

Conclusion

Winter is the major season in India and Indian subcontinent. Lack of management in winter can lead to production and economic losses. If proper care is taken we can achieve optimum production and good profit from the poultry farming. Controlling temperature in winter is major task, can be accomplished by proper brooding, litter material and other shed management as mentioned above. Feed management also plays major role in winter management, giving extra calories in diet to maintain body warmth will always be helpful. Water plays an important role in production and in reproduction, if provides lukewarm water in winters to the bird, it will add extra advantage. Overall, managing poultry farm in winter is difficult task, but with proper management and care we can achieve our goals.

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Poultry Waste Management

S.K. Singh[1] and Rajan Mishra[2]

Poultry meat and eggs provide affordable, quality food products that are consumed by most ethnic populations worldwide. Advances in knowledge and technology over recent decades favour the growth and intensification of poultry production in developing countries where there are increasing human populations and economic constraints. Issues related to the environment, human health and the quality of life for people living near to and distant from poultry production operations make waste management a critical consideration for the long-term growth and sustainability of poultry production in larger bird facilities located near urban and peri-urban areas, as well as for smaller commercial systems associated with live bird markets, and for village and backyard flocks located in rural areas.

These information notes focus primarily on medium-sized to large intensive poultry production units, but many of the principles apply to smaller operations, including small family scavenging flocks. Fundamental knowledge of the environmental and health issues associated with poultry waste management will serve both small and large poultry producers now and in the future, as the intensification of poultry production continues to gain favour globally. There are many different waste management options for litter including land application of litter as an organic fertiliser. Overseas broiler industries have had restrictions placed upon them regarding this practice due to over application of litter which led to pollution. Fortunately, in Australia there are greater agricultural lands that can responsibly utilise litter and growers are generally less concentrated compared to overseas. Therefore, poultry waste managers can rely on land application of litter as a sustainable disposal method for the foreseeable future. That being said, the industry considers all other waste management options and their ability to value add to the litter resource.

Potential pollutants and issues related to poultry production

The production of poultry results in hatchery wastes, manure (bird excrement), litter (bedding materials such as sawdust, wood shavings, straw and peanut or rice hulls), and on-farm mortalities. The processing of poultry results in additional waste materials, including offal (feathers, entrails and organs of slaughtered birds), processing wastewater and bio solids. Most of these by-products can provide organic and inorganic nutrients that are of value if managed and recycled properly, regardless of flock size. However, they also give rise to potential environmental and human health concerns as the sources of elements, compounds (including veterinary pharmaceuticals), vectors for insects and vermin, and pathogenic microorganisms. With the probable exception of veterinary pharmaceuticals, these factors are also relevant to small flocks, including small family flocks that may be partially housed in containment structures.

Managing these poultry by-products as potential pollutants centres on water and air quality concerns, and in some cases on soil quality (FAO, 2008; Nahm and Nahm, 2004; Williams, Barker and Sims, 1999). Specific concerns that are well documented include degradation of nearby surface and/or groundwater, resulting from increased loading of nutrients such as nitrogen and phosphorus (and potassium in some locations). Air quality issues are less well understood and include the fate and effect of ammonia, hydrogen sulphide, volatile organic compounds (VOCs) and dust particulates emitted from poultry production facilities. Greenhouse gas emissions and health effects associated with nuisance odorants are also emerging and/or relevant issues, owing to global climate change and increasing human populations in close proximity to poultry operations, respectively.

Options and considerations for poultry waste management

The planning, construction and operation of poultry meat and egg operations of any size must

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consider issues associated with storing, managing and utilizing potential waste by-products. On a global scale, much research has been conducted on ways of recovering nutrients and value-added organic products from animal wastes, to improve agricultural efficiency and mitigate environmental impacts in their regions. Many systems and approaches can be successful if properly operated and maintained. Land application of crop nutrients globally, poultry manure or litter has been applied to land to enhance crop production for centuries. When properly managed, this is an effective and beneficial option. Environmental pollution occurs when manure or litter is applied to the land in excess of the receiving crop's capacity to utilize the nutrients. Other factors that influence the environmental fate of the manure and litter applied include methods of collecting, storing, and handling, treating, transporting and applying the waste by-products to the receiving land.

For example, with non-liquid-flush systems, the poultry housing and manure storage area should be designed so that the manure and litter are kept as dry as possible, to minimize aerial emissions of gases and assist fly control. Manure and litter storage should be planned to prevent contact with rainfall or rain runoff. Land application should be based on the agronomic uptake of the receiving crop, accurate analysis of the nutrients contained in the manure (particularly nitrogen, phosphorus, copper and zinc) and properly calibrated application methods; it should be avoided when the land is frozen or excessively wet. Land application methods that incorporate the manure or litter directly into the soil minimize odour and gas emissions and surface runoff. These principles also apply to small family operations, whose sanitation will be improved by periodically removing manure or litter from areas where just a few birds are housed, and by storing, composting and/or land-applying the product at least

100 m from where the live birds are kept. Composting is a natural aerobic biological process to breakdown organic matter, which provides a practical and economically feasible method for stabilizing poultry manure and litter before land application (Carr, 1994).

Correctly managed composting effectively binds nutrients such as nitrogen and phosphorus in organic forms, and reduces pathogens, insect eggs and weed seed owing to the heat generated during the biological processing. Composting can also reduce nuisance odour emissions from poultry waste storage and treatment areas. A variety of composting approaches, from very simple to more complex automated systems, are available for both large and small poultry producers. In areas where manure or litter is land-applied near streams or surface waters, an exceptionally simple and effective approach for mitigating surface runoff or the subsurface flow of potential harmful nutrients is to maintain a natural riparian buffer next to the water resources (Wenger, 1999). Riparian buffers may comprise native grasses, shrubs or trees, or a combination of these.

The width and make-up of a riparian buffer are specific to its location, and the width of the buffer from the stream edge determines its effectiveness. Natural grass buffers of approximately 10 m wide have been shown to reduce nitrogen and phosphorus from field surface runoff by approximately 25 percent, while combined grass and tree buffers are much more effective. This practice is a documented inexpensive natural method of protecting water resources from the nutrients and pathogenic microorganisms contained in nearby land-applied poultry manure or litter.

Animal re-feeding

Scientific research has documented that nutrients and energy from poultry waste by-products, including manure and litter, can be safely recycled as a component of livestock and poultry diets when pathogens are neutralized (McCaskey, 1995). Poultry litter has been estimated to be as much as three times more valuable as a feedstuff than as a fertilizer for crop nutrients. However, such practices depend on regional regulations and public perceptions of the concept of animals' consumption of faecal material, regardless of its documented value and safety. If practised, caution is essential. For example, copper toxicity can result when litter is fed to sheep. Incorrectly processed poultry waste can contain potentially pathogenic microorganisms, including Salmonella. Depending on environmental conditions and the global region of production, antibiotics, arsenicals and mycotoxins can also be present in poultry manures and litters.

Bio-energy production

Poultry manure and litter contain organic matter that can be converted into bio energy under certain processing technologies. One of the most common approaches for poultry excrement managed by water flushing (e.g., some layer operations) is anaerobic digestion, which yields biogas, a gas mixture with varying concentrations of combustible methane (FAO/CMS, 1996). The biogas can be used as an on-farm energy source for heat or as a fuel for various engines that generate electricity. An additional advantage is that, depending on processing conditions, an aerobically digested manure solids and liquids are further stabilized and more acceptable and safe for use as a fertilizer or feed supplement.

Litter re-use

One solution to dealing with used or spent litter, widely adopted in the United States of America, is to re-use it for subsequent batches of broilers. While there are cost-saving benefits from not entirely replacing spent litter with new bedding material for each batch, there is also a bonus in that the eventual multi-batch litter makes for an improved compost due to its higher proportion of nutrients from greater proportion of chicken excreta to bedding material in the litter. If there are concerns about carryover of disease organisms in re-used litter, methods to reduce pathogen load developed under Poultry CRC project Methods to quantify and inactivate viruses in poultry litter can be accessed via the following links. These include standard procedures for in-shed pasteurisation of litter between batches and the Litter Heat Map model to predict and optimise temperatures in litter being pasteurised by heaping.

Closed-loop systems

An important concept for a waste manager is a closed-loop system where outputs from one industry become inputs for another. Therefore, pollution could be defined as a resource or raw product that has an adverse effect on the environment which has not been transformed into another useful product. Land application satisfies this requirement as litter is transformed into plants while soil structure is improved by increasing soil organic matter. Composting litter before applying to land can enhance both plant growth and soil structure.

Composting of broiler litter

Composting is the aerobic microbial breakdown of organic matter, usually incorporating a thermophilic phase. The adoption of composting systems for poultry waste has received attention due to its ability to reduce litter volume, dispose of carcasses, stabilise nutrients and trace elements and reduce pathogens. Agronomic benefits of composted litter include increased plant available nutrients and humic residues. The immobilisation of nitrogen (N) and phosphorus (P) during composting reduces the risk of soluble N and P entering aquatic systems via surface flow and leaching. Composting could also offer both on-site and off-site solutions to litter utilisation and potentially enhance a closed-loop system for the Australian poultry industry.

Direct combustion

Direct combustion and incineration are recognised as efficient options for generating renewable energy and fertiliser grade ash from litter and could potentially close the nutrient loop for the poultry industry. There are currently successful large scales off-site electricity utilities operating in the UK that primarily use litter as a fuel. For on-site electricity and heat generation, smaller direct combustion systems are being researched and developed, and if commercialised, could supply Australian broiler growers with both environmentally sustainable waste disposal and energy.

Anaerobic digestion

Anaerobic digestion could also promote a closed-loop system for the poultry industry, as the process could degrade and stabilise a wide range of organic poultry wastes including litter. This could potentially produce saleable methane and digestate. Methane could be captured after digestion, the gas then cleaned and then used as renewable energy, while the digestate could be utilised as a soil improving agent with potentially good fertiliser attributes.

Ethanol production (Bio-fuels)

It is also likely that poultry litter could be suitable for lignocellulosic alcohol production. If this technology is viable, this waste could supply biofuels to Australia and potentially reduce the demand for grain destined for ethanol production.

Vermi-culture

The use of specially selected earthworm species to degrade waste is known as vermiculture. This technique has been widely adopted by home gardeners to utilize green wastes and vegetable scraps. Vermiculture has the potential to produce both humid rich vermi-compost (vermicast) and meat meal (vermimeal) from litter. Traditionally, the vermiculture process has primarily been adopted to produce vermicast, a recognised valuable organic fertiliser.

Conclusion

There is the need to ensure that all poultry farms have sufficient access to adequate supply of water and other sanitary wares that can be deployed for keeping their environment clean and safe at all time. Finally, poultry wastes should be cleared from the farms on daily basis to avoid accumulation of the wastes which could create some health risks to the environment. It is therefore hoped that if these necessary precautionary measures are taken with the required levels of seriousness and in compliance with the appropriate existing government regulations, the negative implications of the poultry wastes on both human and animal lives will be mitigated.

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Making Rural Women Self-Reliant through Improved Animal Husbandry Practices and Veterinary Assistance under Farmer-FIRST Project

Aman Kamboj[1] and Shivendra Kumar Kashyap[2]

Farmer-FIRST project of ICAR which is in operation since 2016 in three hilly villages of Uttarakhand is mainly focused on improving the socioeconomic status of women farmers and making them self-dependent through improved Animal Husbandry practices. The outcomes of interventions are very encouraging.

Farmer-FIRST(Farm, Innovations, Resources, Science and Technology) project is a flagship programme of Indian council of agricultural research (ICAR) initiated in October 2016 with an aim to establish interface between farmers and scientists, capacity building, technology adaptation and application, and content mobilization. The project is being implemented in three villages of Nainital district Uttarakhand namely Dogra, Syalikhet and Jeoli from Bhimtal block. Uttarakhand is a state with diverse agro climatic conditions and its economy is mainly dependent on agriculture and tourism, however, the ridges and valleys makes agriculture difficult. A benchmark survey was conducted before the implementation of project and it was found that there is a very limited land holding of farmers in the selected villages which is even less than 1 nali (20.17 nali=1 acre) for majority of households. The villagers are practicing animal husbandry since long and it is mainly dependent on women because all the activities of animal husbandry are performed by women. It was found that there were several constraints in practicing animal husbandry in hilly areas like non-availability of fodder round the year, inadequate knowledge about good animal husbandry practices and poor veterinary assistance at their doorstep. This leads to low productivity and high economic losses in the form of production losses and cost incurred on treatment of diseases and high mortality due to diseases. The predominance of local and less productive breeds of livestock (cattle, buffalo, goat) and poultry was also found. Due to these reasons, it was thought to introduce animal husbandry module in the farmer-FIRST project which was aimed toward improving livelihood opportunities for rural communities of Dogra, Syalikhet and Jeoli through improved and scientific animal husbandry practices like introduction of improved animals, distribution of inputs, imparting technical knowledge by hands-on trainings and veterinary assistance in the form of health camps.

The farmers of Dogra and Jeoli village were mainly practicing dairy farming and the predominant problems in these villages were low milk production, poor reproductive performance of animals, and scarcity of fodder. To solve these problems the rural families were educated to use the mineral mixtures, unconventional feeds and fodder, use of hay and silage, improved housing and sanitization practices for animal sheds, regular vaccination and deworming of animals and biosafety measures to prevent the infectious diseases. Various lectures for farmers were organized in which the farmers were interacted with the scientists of Pantnagar university. Veterinary health camps were also organized in the villages where the general examination of animals was done by veterinarians. Also, the literature developed under farmer-FIRST project related to various aspects of improved animal husbandry practices was distributed to farmers. The impact of this was that the remarkable improvement in the productivity of animals were observed in the form of improved calving rate and increased milk production.

Another important issue which was addressed by animal husbandry module of farmer-FIRST project was increased drudgery on rural women which leads to serious health problems. The drudgery and inconvenience are mainly caused to women during various animal handling practices like milking, cleaning and chaff cutting by hands. To solve these issues the selected women were provided drudgery reduction kit which includes revolving stool for miking, dung collector, and a bag with small

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drudgery reduction tools. The chaff cutters were also installed at some common places in the villages which reduced the efforts involved in the fodder cutting and also improved the quality and palatability of fodder.

Syalikhet village was the third villages undertaken in the project which was mainly dependent on poultry farming. Almost all the families of this village consist of landless or marginal farmers with the limited income. The people mainly work as daily wage workers and the males of the village left the village and migrated to cities to earn their livelihood. Presently the village is inhabited by almost cent percent women and, therefore, women of Syalikhet village comprise the main workforce in animal husbandry. Due to limited landholding and scarcity of fodder and other facilities most of the villagers were not involved in dairy farming. Hence, backyard poultry farming was identified as a potential intervention for Syalikhet as it requires low initial expenditure and not require much space and sophisticated equipments. The beneficiaries were provided with one month old chicks (20 chicks to each household) along with feed, nutrient supplements, and raw material for constructing low-cost poultry houses. Taking into consideration,the distinctive characteristics and advantages of first and only registered poultry breed of Uttarakhand,*'Uttarafowl',* was propagated in Syalikhet with comprehensive feeding, health and management practices. The breed is reared for both eggs and meat and the market rate of its egg is comparatively high as it is generally known as *desi* egg with more nutritious value. The outcome of this intervention was very encouraging and remarkable increase in income of women was observed. Now, each of beneficiary women of Syalikhet village is earning an average additional income of Rs. 2491 per month from poultry farming. Due to this, backyard poultry became a sustainable model for Syalikhet and the village is now renowned as *poultry village* in the nearby localities. Recently, another intervention under animal husbandry module is introduced in Syalikhet that is goat farming. Fifteen families were selected to provide the goats along with feed. They were also educated with the principles of profitable goat farming and provided with veterinary assistance and now they are getting additional income from goat farming as well.

Hence farmer-FIRST project has been emerged as a successful experiment and an efficient step toward doubling the income of farmers and especially the women farmers in our context. With this the women of hills is becoming self-dependent and heading toward a bright future.

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