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Sweet sorghum

an alternative for bio ethanol production

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Azolla Cultivation:

A Solution to Agriculture Food Security

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Abstract

Azolla is a free floating water fern. It is a common bio-fertilizer in rice crop. The blue-green algae (Anabaena azollae) grow in symbiotic association with this fern and are responsible for nitrogen fixation. Among different species of genus Azolla, A. pinnata is popular. It's high in protein and minerals, fixes nitrogen, is palatable to chickens, pigs, goats, ducks and cows, and can be grown on any closed body of water.

Key Words: *Azolla, Forage, N-fixation, Green manure,Environment*

Azolla is naturally found in ponds, ditches and wetlands of warm temperate and tropical regions throughout the world. It requires light for photosynthesis and grows well in partial shade. Generally, Azolla needs 25 to 50 per cent of full sunlight for its normal growth. Water is the basic requirement for the growth and multiplication of Azolla and is extremely sensitive to lack of water. Maintenance of adequate water level (at least 4 inches in the pond) is essential. The species vary in their requirement of ideal temperature. In general, the 0 0 0 optimum is 20 C to 30 C. Temperatures above 37 C will seriously affect the multiplication of Azolla. The optimum relative humidity is 85 to 90 per cent. The optimum pH is 5 to 7. Too acidic or alkaline pH has an adverse effect on this fern. Azolla absorbs the nutrients from water. Though all elements are essential, phosphorus is the most common limiting element for its growth. About 20 ppm of phosphorus in the water is optimum. Micronutrient application improves the multiplication and growth.

For cultivation of Azolla, a shallow fresh water pond is ideal.The size of pond depends on factors like number of animals, quantity of supplemental feed required and availability of resources. For small holders, an area of 6 X 4 feet for Azolla cultivation can produce about one kg of supplemental feed per day. Selected area should be cleaned and levelled. The side walls of the pond can be of either bricks or raised embankment with the excavated soil. After spreading the durable plastic sheet (s in the pond, all the sides have to be secured properly by placing bricks over the side walls.

After the inoculation of culture, the pond needs to be covered with a net to provide partial shade and also, to prevent the fall of leaves and other debris into the pond. Thin wooden poles or bamboo

sticks are to be placed over the pond walls to support the shade net. Bricks or stones can be used as weights on the edges for securing the plastic sheet and also, the net over the pond area. Sieved fertile soil mixed with cow dung and water need to be spread uniformly in the pond. About one kilogram of fresh Azolla culture is needed for a pond of 6 X 4 feet size. It has to be applied uniformly in the pond. Biogas slurry can also be used instead of dung. The depth of water should be four to six inches. During the monsoon season, if rain water can be harvested from the roof tops and used for cultivation of Azolla, it will ensure excellent and faster growth of Azolla. If the total salt content of the water used for growing Azolla is high, it will adversely affect the growth. Application of about one kg of cow dung and about 100 grams of super phosphate once in two weeks will ensure better growth of Azolla. Any litter or aquatic weeds seen in the pond should be removed regularly. The pond needs to be emptied once in six months and cultivation has to be restarted with fresh Azolla culture and soil. Application of about one kg of cow dung and about 100 grams of super phosphate once in two weeks will ensure better growth of Azolla. Any litter or aquatic weeds seen in the pond should be removed regularly. The pond needs to be emptied once in six months and cultivation has to be restarted with fresh Azolla culture and soil.

Production of Azolla :

Depending on the initial quantity of culture added, environmental conditions and nutrition, Azolla's growth in the pond will be complete in about two to three weeks time. It can be harvested daily after the full growth. Plastic sieves can be used to harvest the biomass from the pond's surface. About 800 to 900 grams of fresh Azolla (mean yield per day in a season) can be produced from an area of 6 X 4 feet.

BENEFITS

Forage management

Azolla is a highly productive plant. It doubles its biomass in 3-10 days, depending on conditions, and yield can reach 8-10 t fresh matter/ha in Asian rice fields. In India, yields of 37.8 t fresh weight/ha (2.78 t DM/ha) have been reported for *Azolla pinnata*.

Production for biofertilization

Production of azolla for green manure is done according to 3 systems. It can be grown as a monocrop and then incorporated as foundation manure before the rice is transplanted, or transported to another site for use on upland crops. Monocrop azolla has been used in China and Vietnam during winter and spring to produce nitrogen for the spring rice crop. Azolla can also be grown as an intercrop, and used as a top dressing manure after the rice is transplanted. This is done in places where there is no time available in the cropping system for growing azolla as a monocrop. It can also be grown both as a monocrop and an intercrop. This technique is designed to grow azolla before planting the rice crop, allowing production of added nitrogen for the crop through cultivation of intercropped azolla.

Production of azolla for livestock feeding

Azolla can be fed to the livestock either in fresh or dried form. It can be given directly or mixed with concentrates to

cattle, poultry, sheep, goat, pigs and rabbits. Feeding of Azolla @ 800 grams (fresh weight) on an average per day, improved the monthly milk yield by at least 10 liters per cow. It takes a few days for the animals to get used to the taste of Azolla. So, it is better to feed it along with the concentrates in the initial stages. Azolla has to be washed thoroughly with fresh water to remove the smell of dung.

ENVIRONMENTAL IMPACT

N-fixation and green manure

The main reason for the enduring popularity of azolla among agriculturists is its ability to fix nitrogen, valuable in paddy fields under waterlogged or flooded conditions where N-fixating legumes cannot grow. It is also a source of green manure for upland rice growing on the most fertile soils that farmers are reluctant to use for legume crops. In 25 to 35 days azolla can easily fix enough nitrogen for a 4 to 6 ton/ha rice crop during the rainy season, or a 5 to 8 ton/ha crop under irrigation during the dry season. Azolla also contributes to maintaining soil fertility, by providing nutrient-rich humus through its decomposition.

Limitation of N volatilization

By reducing light intensity underwater, azolla inhibits algae photosynthesis and the subsequent increase in pH and NH_3 volatilization. Because up to 50% of N fertilizer applied to paddy fields is lost in volatilization, azolla could help to reduce the amount of N fertilizers in rice crops.

Weed control

It has been empirically observed, and well appreciated by rice farmers, that azolla suppresses the growth of some aquatic weeds by forming a thick mat that deprives weed seedlings of sunlight while mechanically preventing them from emerging.

Mosquito control

The ability of azolla to prevent mosquito breeding and thus the spread of paludism was suggested in the early 20th century (hence the name "mosquito fern") but was demonstrated only in the late 1980s by Indian and Chinese researchers. For example a Chinese experiment in controlled conditions showed that full or 2/3 azolla cover could prevent or limit the oviposition of *Culex* mosquitoes. It did not prevent ovipositing of *Anopheles sinensis* but limited the emergence of adult insects. These findings were later confirmed in field trials that showed that larval density was greatly reduced when 75% of the water surface was covered by azolla. However, there are some doubts about the efficiency of azolla in mosquito control, since the coverage required for a significant reduction in mosquito populations may be impossible to obtain in practice.

Bioremediation

Azolla can accumulate excessive amounts of pollutants such as heavy metals, radionuclides, dyes, pesticides, etc. For that reason, it has been extensively studied and tested since the 2000s as a candidate for the bioremediation of waste waters and effluents.

Integrated farming systems

Numerous integrated farming systems have been designed where combinations of azolla, rice (or another crop), fish, ducks and pigs can complement each other.

CONCLUSION

Azolla can be used as an ideal feed for cattle, fish, pigs and poultry, and also is of

value as a bio-fertilizer for wetland paddy.It is eco friendly organic feed for animals and crops.

REFERENCES

Abou, Y. ; Aina, M. P. ; Fiogbe, E. D. ; Micha, J. C., 2013. Growth and fatty acid composition of Nile tilapia *Oreochromis niloticus* L. fed *Azolla*-diets, in tanks and in earthen ponds: a comparative study. Natural Science, 5 (1): 77-83

El-Sayed, A. F. M., 1992. Effects of substituting fish meal with *Azolla pinnata* in practical diets for fingerling and adult Nile tilapia, *Oreochromis niloticus* L.. Aquacult. Res., 23 (2): 167-173

Huggins, D., 2007. Evaluation of Azolla plant as an alternative stockfeed source. 13th December 2007 Prepared For: Goulburn Broken Catchment Authority

P. Kamalasanana Pillai, S. Premalatha and S. Rajamony. *"Azolla – A sustainable feed substitute for livestock*". Farming Matters magazine. Retrieved 2008-01-14.

Sjodin, Erik (2012). *The Azolla Cooking and cultivation Project*. ISBN 978-9198068603.

Feeding Management to Improve Reproductive Performance in Bovines

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Feeding management plays an important role in successful reproduction. Deficiency of various trace minerals, inadequate vitamin intakes, energy protein imbalances and excessive protein intakes are reported as contributors to infertility and poor reproductive performance and leading to economic losses to dairy farmers. Animals with superior genetic merit contribute to more milk production. The dairy cow has changed significantly over the last decades with a remarkable growth in milk production. Nutritional management of cow, especially during periods of high levels of stress is an important and challenging target to maintain and improve animal health and reproduction.

Energy requirement and reproduction: Energy intake is most important nutritional factor affecting reproduction on most dairy farms. It affects reproductive performance in early lactating cows and heifers if insufficient energy is taken. The nutritional requirements of a dairy cow significantly support foetal growth, mammogenesis and lactogenesis during late pregnancy and early postpartum. The negative effect of NEB affects on animal health and reproduction. When cows having a period of NEB, blood levels of non-esterified fatty acid (NEEFA) increase as a consequence of body energy reserve mobilization (adipose tissue), at the same time insulin-like growth factor-I (IGF), glucose and insulin are low. Cows that are over energy when they calve have a higher incidence of retained placenta more uterine infections and more cystic ovaries. All of these problems can result in poor reproductive performance. Achieving a body condition score of 3.5 at calving (0-5 scale) should be the target. Adequate dry matter intake about 2.8-3.5% (as per feeding standards) of total mixed ration (TMR) having crude protein 14-16%, fat 5-6%, NDF about 34%, TDN around 70.00% (about 1.63 NE lactation Mcal/kg). An adequate macro and micro nutrients helps in maintaining the optimum fertility in dairy cows.

Protein requirement and reproduction:

Over last some years more importance has been put on rumen, soluble, degradable protein and its role in reproduction. These proteins are degraded by the rumen microbes (bacteria) into ammonia.In case when large amount of ammonia is produced, the excess amount of it gets absorbed into the blood stream and is converted to urea by the liver. High blood urea will result in increased risk of early embryonic mortality, impaired sperm viability and decrease progesterone concentrations.

Reproductive performance reduces due to inadequate protein intake from long times. Excess of dietary protein has been suggested as detrimental to fertility. The protein level of greater than17-20% may reduce conception rate and increases number of services per conception and also days open. The excess ammonia and urea in the blood stream may decrease fertility at the same time energy is diverted away from milk production and reproduction. Some studies have indicated that blood urea nitrogen (BUN) above 20 mg/100 ml may decrease the chances of pregnancy.

FAT REQUIREMENT AND REPRODUCTION

In bovines certain fatty acids may play an important role in reproduction. Linoleic and linolenic have a beneficial impact on reproduction. There are a couple of potential mechanisms as to how these fatty acids can improve reproduction, including:

1. Increased progesterone concentration: Higher concentration of progesterone will lead to better pregnancy rates. Progesterone has main function is to prepare uterus for pregnancy by reducing uterine contractions.
2. Decrease prostaglandin secretion: Prostaglandins act in opposite manner of progesterone. They induce uterine contractions and eliminate the CL and consequently progesterone production thus potentially reducing pregnancy rates when an egg is fertilized.

Supplementation of moderate amounts of fat to the diet improve energy intake, modulate PGF2α secretion by the uterus, affects ovarian dynamics, enhances luteal function and embryo quality and has moderate positive effects on fertility.

NUTRIENTS AND REPRODUCTION

Right level of minerals and vitamins also very important for successful reproduction. Deficiency of some minerals and vitamins will have a more effect on reproduction. These trace minerals bound to small protein fractions (amino acids) and are more bio-available than inorganic forms.

Minerals: Mineral deficiencies and imbalance often causes of poor reproduction.

Phosphorus: Phosphorus is one of the important elements for normal sexual behaviour in dairy cows. P deficiency leads to delayed onset of puberty and silent or irregular oestrus in heifers, failure of oestrus and long inter calving period in cows, still born or weakly expelled calves or even embryonic death due to lack of uterine muscle tone, decreased ovarian activity, delayed sexual maturity and moderate deficiency may lead to repeat breeding condition and poor conception rate. The excess of P in diet renders the endometrium susceptible

for infection. Phosphorus deficiency during dry period has been incremented for vaginal or uterine prolapse. Concentration of P in the seminal plasma of active bulls was positively correlated with quantity and quality parameters of bull semen. Only in extreme deficiencies (0.2 -0.25% of the diet) dose phosphorus reduce reproductive performance.

Calcium: Calcium is required for many physiological processes as a regular in all living cells including sperm cells. Deficiency disorders of calcium are very common during parturition or within few days following parturition. Altered of Ca:P ratio, affects ovarian function through its blocking action on pituitary gland which results in prolongation of first oestrus, ovulation, prolonged uterine involution, increased incidence of dystocia, retention of placenta and uterine prolapsed potentially leading to impaired fertility. Moreover, excess of Ca can also affect reproductive status of animal by impairing of P, Mn, Zn, Cu and other element from gastro intestinal tract. Ca: P ratio of under 1.5:1 or > 3:1 could potentially lead to reproductive problems.Ca should be balanced for 0.9-1.0% of the diet.

Sodium and Potassium: Sodium and Potassium are the principal cations in extracellular and intracellular fluids, respectively. Sodium and potassium are responsible for maintenance of osmolarity and activity of spermatozoa. It also regulates sperm motility and the acrosome reaction. Deficiency of Na causes general infertility and embryonic mortality in several farm animals. Feeding of high level of K may delay the onset of puberty, delay ovulation, impair corpus luteum development and increase incidence of anoestrus in heifers. Too more K: Na leads to lower fertility in cows.

Magnesium: Magnesium has an important effect on reproduction and is also required during gestation and lactation. During pregnancy, a positive correlation was observed between plasma concentrations of progesterone. During high energy requirement, Mg requirement increased manifold. Mg is an active component of several enzyme systems in which thymine pyrophosphate is a cofactor

Selenium: Selenium plays a very important role in maintaining high fertility. Selenium is a component of glutathione peroxidase, which protects cells from per-oxidative damage. In female, Se deficiency leads to silent heat periods, poor fertilization, delayed conception, cystic ovaries, reduced sperm motility, reduced uterine motility, metritis, mastitis and retained foetal membrane. In males, Se deficiency reduces sperm viability. Selenium deficient herds received supplement selenium (50 mg) and vitamin-E (680 IU) injections at 20 days prior to calving or were fed 1 mg of selenium per day.

Iodine: Reproduction is influenced through iodine's action on the thyroid gland. Iodine supplementation has been recommended when necessary to insure that cows consume 15-20 mg of iodine each day. More doses of iodine reduce resistance to infection, disease and abortion. Iodine deficiencies may indirectly cause early embryonic death, abortion, still births prolonged gestation and an increase in the incidence of retained placenta.

Zinc: Zinc is involved in several enzymatic reactions associated with

carbohydrate metabolism, protein synthesis, nucleic acids metabolism and steroidogenesis. Zinc has got a vital role in sexual maturity, onset of estrus and maintenance of the endometrial lining after parturition. The foetus requires Zn for normal growth and development. Zn deficiency results in foetal teratogenesis, abortion, foetal mummication, prolonged gestation, difficult labour, low birth weight and weak offspring. Zn deficiency in male causes atrophy of semniferous tubule and in efficient testicular development in young ones, leading to reduced testicular size, lack of libido and can adversely affect spermatogenesis. Zn supplement fed bulls led to sperm concentration, percentages of live sperm, motility, high semen volume. Zinc should be added at 75 mg/ kg of the diet.

Manganese: Manganese is required for activation of many enzymes systems, activity of certain endocrine organs, normal parturition and also involved in luteal tissue metabolism. Deficiency of Mn causes silent estrus and anoestrus or irreregular oestrus, cystic ovary, poor follicular developments with delayed ovulation, decreased conception rate, birth of deformed calves, abortion and absence of libido, decrease motility of spermatozoa and oligozoospermia in ejaculate and failure of spermatogenesis. Heifers fed inadequate Mn in the diet showed late sign of estrus than supplemented with Mn and also exhibited lower conception rates. Manganese is generally added @50 mg/kg of the diet.

Cobalt: Cobalt is an important component of vitamin-B_{12}. Depletion of Cobalt at parturition results to a decline in milk production. Clinical signs of cobalt deficiency in female include delayed puberty, anaemia, delayed involution of uterus and reduced conception rate, anestrus and abortion. In males, Cobalt deficiency is decreases libido, reduces spermatogenesis and sterility in males. Cobalt should be added at 0.5 mg/kg of the diet.

Molybdenum: Molybdenum work as protein synthesis, metabolization and utilization of iron store in the body, with subsequent direct effects on biological process controlling growth and reproductive performance. Molybdenum deficiency in female causes delayed puberty, reduced conception rate, anestrus and in male decreased libido, reduced spermatogenesis, causes sterility.

Copper: It is an enzyme component and catalyst, Copper deficiency is associated with early embryonic death, reduced ovarian activity, decreased conception rate, increased incidence of retained placenta and increased difficulty in calving. The recommended is to feed 20 mg/kg of added copper to diet.

Iron: Iron is necessary component of haemoglobin and myoglobin for oxygen transport and cellular use. Deficiency of iron, affects response of ovarian receptor to estrogens hormones, become repeat breeders and occasionally may abort in female. Iron content within the seminal plasma is important for the preservation of sperm motility and viability after ejaculation and its presence helps spermatozoa to maintain their functions.

Chromium: Chromium is crucial for carbohydrate and lipid metabolism. It is present in high concentration in nuclear proteins thus it is necessary for gametogenesis and healthy foetal growth. Cattle placed on chromium supplementation had an increased

pregnancy rate and interval from calving to first estrus.

Vitamin: Good amount of vitamins and minerals balance in dry cow ration is drawing more attention especially when feed intake is restricted and low quality forage is fed to control or reduced body condition. Providing optimum amount of vitamins A and E may improve the immune status of the periparturient cows thus decreasing the incidence of retained foetal membranes, mastitis and improve pregnancy rate.

Vitamin A: Beta-carotene is a substance found in many plants and bovine changes this into vitamin A. Vitamin A is important in maintaining the health and integrity of the epithelial tissue. The vitamin is required for steroidogenesis. Deficiency causes delayed puberty, delayed first oestrus after calving, low conception rate, high embryonic mortality, reduced libido in deficient cattle, abortion, delayed sexual maturity, the birth of dead or weak calves, metritis, retained foetal membrane, reduced gestation period and increase incidence of cystic ovaries have been reported. The daily supplementation of vitamin A to dairy cows is about 30,000-50,000 units. The current feeding recommendation (dairy NRC, 2001) for vitamin A (110 IU/kg body weight) revealed optimum amount.

Vitamin D: It is needed for normal metabolism of calcium and phosphorus. Vitamin D may be indirectly needed for reproduction. Cows receiving a normal amount of natural light manufacture their own vitamin D. Most commercial concentrates contains vitamin D in amounts sufficient to meet the cows requirements of 10,000 IU per day. The dietary supplementation of Vitamin D should be 1600-1700 IU/kg dry matter of the diet. Deficiencies of vitamin D causes to metritis, anestrum, milk fever, and retained placenta in dairy cows and impotentia coeundi in bulls.

Vitamin E: Vitamin E is plays a vital role in regulating immune functions and works in association with selenium. Vitamin E has been found to minimize the chances of retention of fetal membranes in cows. It is reported that supplementation of greater than 2000 IU/day of Vitamin E during transition period reduces incidence of mastitis and retained fetal membranes.

Vitamin B Complex: Reduction in appetite and decrease in feed intake occurs in vitamin-B_{12} deficiency which further leads to delay to sexual maturity and atrophy of the ovaries and uterus in cows. Cobalt is essential for vitamin-B_{12} synthesis. In case of biotin, biotin supplementation is essential. In an experiment feeding of 200 mg/day reduce conception days from 169 to 108 and reduces service per conception from 2.96 Vs 1.7.

APPLICATION OF CURRENT NUTRITIONAL CONCEPT FOR FERTILITY MANAGEMENT:

- Niacin feeding can prevent ketosis and maintain dry matter intake. The current recommended is to feed 6-12 grams/day until maximum dry matter in takes occurs (10-12 weeks postpartum).
- Buffers used as additive to maintain rumen pH between 6-6.3 Sodium bicarbonate and sodium sesqui-carbonate are the most common commercial products fed at 120-250 grams/cow/day.

- Propylene glycol use, it is converted by liver to glucose which can prevent ketosis and fatty liver formation.
- Yeast culture and yeast products can activate fibre fermenting bacteria, maintain rumen pH, and stimulate volatile fatty acid (VFA) production. Yeast product can also be kept as for cattle feed and these are palatable. The level of yeast cultures and products vary from10-115 grams/cow/day.
- Reducing heat stress, in dairy cattle can improve production and fertility. Early lactation cows are most severely affected. This decreased feed intake changes the environment of the rumen and leads to acidosis and decreased fat content of milk.
- Maintaining a body condition score 3.0 - 3.5 at calving. Over feeding cows are more prone to uterine infection, retained placenta, ketosis and displaced abomasums.
- Protein level – Feeding inadequate level of protein feeding upto 12-14% and close to14-16% has been shown to increase the incidence of retained fetal membranes.
- Urea nitrogen and fertility: It is well known that daily intake of high protein increases milk production in dairy cows. However, at the same time, dairy cows fed high protein increases blood urea nitrogen (BUN) concentration, which is associated with reduced reproductive performance.
- Potassium level: High potassium will increase the incidence of milk fever and other fresh cow problems. Forages with low potassium content should be fed to keep levels of potassium under 1.5%. Adequate dietary fibre: Maintain an adequate level for early lactating cows (minimum22-24% forage. Feed high quality, forage results in higher dry matter intakes. Avoid feeding stale or mouldy feed to cows because mouldy feed contain estrogenic compounds that can effect reproduction.
- Higher levels of vitamin E and adequate selenium intake will improve immune function and reduce the incidence of RFM. Close up cows should receive at least 1000-1300 IU of vitamin E.
- Fat: Consider feeding supplemental protected fat to improve energy status.
- Macro minerals: Calcium 0.60%,Phosphorus 0.38%, Magnesium 0.20%, Potassium 0.90%, Sodium 0.18%, Chloride 0.25%, Sulphur 0.20%.
- Trace minerals: Iron 50 ppm, Cobalt 0.10 ppm, Copper 10 ppm, Manganese 40 ppm, Zinc 40 ppm, Iodine 0.60ppm, Selenium 0.30ppm.
- Vitamins: Vitamin A 3190IU/kg, Vitamin D 990IU/kg, Vitamin E 15 IU/kg.

CONCLUSION

Management of feeding in bovines is essential for their proper production and reproduction. Infertility and other related problems such as poor reproductive performance caused due to deficiencies of trace minerals, inadequate intake of various vitamins, imbalances in energy and proteins lead to heavy economic loss to dairy farmers. A balanced ration supplying adequate quantities of minerals, vitamins, protein and energy balance is essential for proper production and reproduction of livestock.

Modern Hydroponics Production Systems

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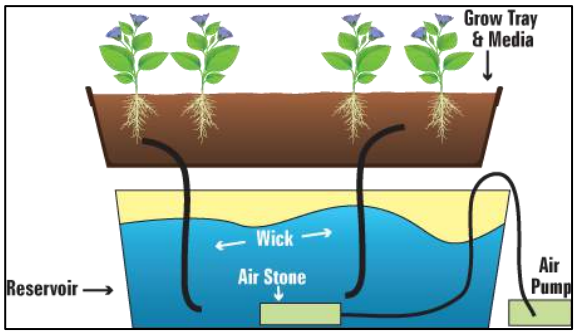
Open field production systems are by far the most common production systems those account for nearly 12,00 million tons of vegetables production annually world. Over the year the scope of hydroponics has increased many folds and an outline of the technology is presented here under as the term 'Hydroponics' is derived from two Greek words Ponics (toil) and Hydro (water) that started to be used since 1950. Plants in hydroponic production system are placed in a nutrient that is directly provided to the roots. Many people are surprised that plants don't require soil to live, but soil can sometimes be a very inefficient growing medium. Plants expend a great deal of energy growing root systems so they can search the soil for the water and nutrients they need to survive. By providing constant and readily available nutrition, hydroponics allows plants to grow up to 50% faster than they do in soil. Hence the soil is substituted by a soilless growing medium, mostly consisting of water containing nutrients in hydroponic production.

HYDROPONICS SYSTEMS:

1. Wick Hydroponic System

The wick hydroponic system is the simplest and typically the most inexpensive system and it is a "passive system", which means that it does not have any moving parts. It works by drawing the necessary nutrients into the growing medium from a reservoir with a wick. The biggest drawback of this system is that plants that are large or use large amounts of water may use up the nutrient solution faster than the wick can supply it. This should only really be used for smaller plants that do not require much nutrients or moisture, as the wicks cannot supply the plants with these things very quickly.



2. Ebb and Flow Hydroponic System

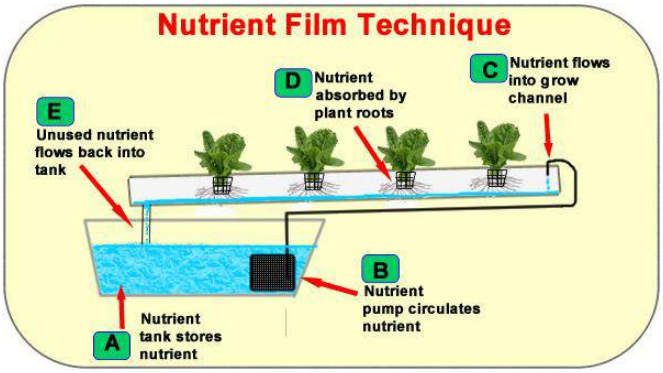
The Ebb and Flow system, which is sometimes referred to as the "Flood and

Drain" system, is a much more advanced and complicated system. This system works by using a pump that is placed into the reservoir to regularly flood the grow tray with the nutrient solution and then draining it back into the reservoir. The pump floods the tray or bucket at regular intervals for a set period of time by using a timer. The advantage of the bucket or modular system is that each plant is grown in its own container and therefore can be moved or handled much more easily.

The Ebb & Flow is a versatile system that can be used with a variety of growing mediums. The entire grow tray can be filled with Grow Rocks, gravel or granular Rockwool. Many people like to use individual pots filled with growing medium, this makes it easier to move plants around or even move them in or out of the system. The main disadvantage of this type of system is that with some types of growing medium (Gravel, Growrocks, Perlite), there is a vulnerability to power outages as well as pump and timer failures. The roots can dry out quickly when the watering cycles are interrupted. This problem can be relieved somewhat by using growing media that retains more water (Rockwool, Vermiculite, coconut fiber or a good soilless mix.

3. Nutrient Film Technique (NFT)

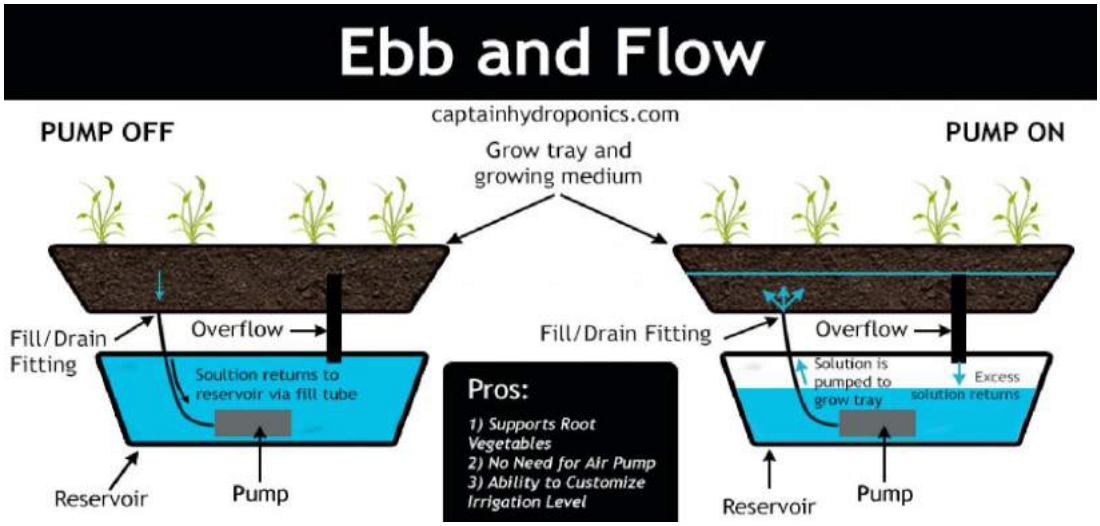
This is the kind of hydroponic system most people think of when they think about hydroponics. NFT system delivers a constant flow of nutrients to the plants with a pump, so no timer is required. There is usually no growing medium used other than air, which saves the expense of replacing the growing medium after every crop. Normally the Source:



http://www.simplyhydro.com/hydrou.htm plant is supported in a small plastic basket with the roots dangling into the nutrient solution. This N.F.T. systems are very susceptible to power outages and pump failures. The roots dry out very rapidly when the flow of nutrient solution is interrupted.

4. Drip Irrigation Hydroponic System

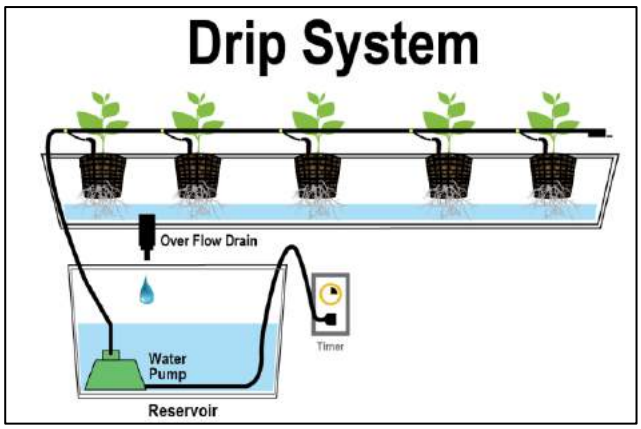
In this system, a timer delivers the



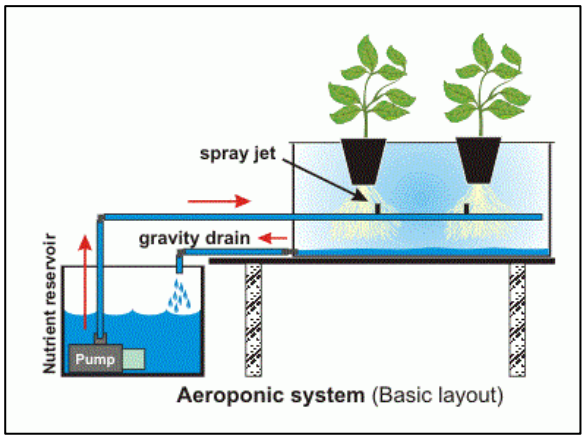
nutrient solution through the base of each plant through drippers. Continuous drip systems can be recovery or non-recovery, meaning that the used nutrient solution can either be returned to the reservoir or run off as waste. Recovery systems are more cost effective because they use the nutrient solution more effectively, but non-recovery systems require less maintenance because the pH balance and nutrient strength remains constant. A recovery system uses nutrient solution a bit more efficiently, as excess solution is reused, this also allows for the use of a more inexpensive timer because a recovery system doesn't require precise control of the watering cycles. The non-recovery system needs to have a more precise timer so that watering cycles can be adjusted to insure that the plants get enough nutrient solution and the runoff is kept to a minimum. The non-recovery system requires less maintenance due to the fact that the excess nutrient solution isn't recycled back into the reservoir, so the nutrient strength and pH of the reservoir will not vary. This means that you can fill the reservoir with pH adjusted nutrient solution and then forget it until you need to mix more. A recovery system can have large shifts in the pH and nutrient strength levels that require periodic checking and adjusting.

5. **Aeroponic System**

Aeroponics is a newer and more high tech method of hydroponic growing. There is no growing medium as like the nutrient film technique. The plants are suspended with the roots in the air and the nutrients and moisture are supplied in the form of a mist. A timer ensures that the pump delivers a new spray of mist every few minutes.



Like the nutrient film technique, it is imperative that the pump is always functioning correctly, because even a brief interruption can cause the roots to dry out. Root Mist Technique (RMT) and Fog Feed Technique (FFT) are the two important Aerophonic Hydroponic Techniques in use.



6. Growing on Solid Media

The growing medium for hydroponic gardening is an inert medium which does not provide any nutrients to the plant. It only provides the basis for the roots to grow in. Coco coir fiber, Rockwool, Perlite, Vermiculite, LECA, Expanded clay, crushed granite, Sand, Scoria, Gravel are the various types of growing mediums available for growing plants hydroponically. A growing medium allows us to add the correct amount of nutrients and also monitor the pH in a hydroponic

system. In addition, using a growing medium other than soil has several advantages that include:

1. Prevention of root infestations,
2. Retention of adequate oxygen and water
3. Increased aeration and draining.

7. Aeroponics for Root Cultivation

The aeroponic system is probably the most high-tech type of hydroponic gardening. Like the N.F.T. system above the growing medium is primarily air. Aeroponics is a form of hydroponic plant cultivation in which plant roots are suspended in a closed chamber and misted with a complete nutrient solution. Aeroponics requires no solid or aggregate growing medium and allows for easy access to roots. The roots hang in the air and are misted with nutrient solution. The misting are usually done every few minutes. Because the roots are exposed to the air like the N.F.T. system, the roots will dry out rapidly if the misting cycles are interrupted. The chamber and misting system provide complete control of the root zone environment, including temperature, nutrient level, pH, humidity, misting frequency and duration, and oxygen availability. 1) Clean root material free of soil, soil-borne organisms, or adulteration from foreign plant species contaminants, 2) Potential for improved root yield and phytochemical consistency due to uniform nutrient and water availability, and reduced risk of diseases.

Requirements of Hydroponics /Aeroponics-

Greenhouse- Commercial hydroponics or aeroponics are practiced under GH conditions, where light, water, temperature and humidity are kept under control.

Nutrient Solutions- The hydroponic system provides nutrition to plants through nutrient solution i.e. essential plant nutrients dissolved in water. The nutrient solution (NS) circulates in the system. These solutions are regularly replenished with water and nutrients and then its EC and Ph is maintained.

Elements

Elements	ppm	Elements	ppm
N	210	Mn	1.25
P	70	Fe	3.0
K	300	Cu	0.26
Ca	180	B	0.5
Mg	67	Zn	0.40

The E.C. (electrical conductivity) of this formula should be approximately 2.5 and the pH adjusted to 5.5 - 6.5. Under these conditions, a smaller root system develops and more energy is available for shoot (vegetative) growth. The higher E.C. ensures adequate nutrition even with a smaller root system. Following seeding or root cuttings, the first watering should be with a half-strength nutrient solution, pH 5.8; however, the phosphorous concentration should be maintained at 80 ppm. Following germination, or after the first root initiate on the cuttings, the full strength nutrient solution should be used.

Growing Mediums

The purpose of a growing medium is to aerate and support the root system of the plant and to channel the water and nutrients. Different growing mediums work well in different types of hydroponic systems. A fast draining medium, such as Hydrocorn or expanded shale works well in an ebb and flow type system. Hydrocorn is a light expanded clay aggregate. It is a light, airy type of growing medium that allows plenty of oxygen to

penetrate the plant's root system. Both types of grow rocks can be reused, although the shale has more of a tendency to break down and may not last as long as the Hydrocorn. These grow rocks are very stable and rarely effect the pH of the nutrient solution.

Rockwool has become an extremely popular growing medium. Rockwool was originally used in construction as insulation. There is now a horticultural grade of Rockwool. Unlike the insulation grade, horticultural Rockwool is pressed into growing cubes and blocks. It is produced from volcanic rock and limestone. Since Rockwool holds 10-14 times as much water as soil and retains 20 percent air it can be used in just about any hydroponic system.

CONCLUSION:

Hydroponics is for a bigger, better, higher quality crop. Hydroponics gives hope for food production to areas of the world with poor or infertile soils. This gives populations of people in these areas access to healthy produce. The vegetables grown in these areas, and other places with hydroponic systems, are fresh, delicious and full of flavor- even more so than their soil counterparts. Hydroponics empowers communities that would otherwise not have access to fresh and delicious food.

REFERENCES

Christopher L. Pagliarulo, Anita L. Hayden, Potential For Greenhouse Aeroponic Cultivation of Medicinal Root Crops, (1-2), Department of Plant Sciences, University of Arizona, PO Box 210038, Tucson, Arizona 85721-0038 USA.

Mugandhan M., Soundaria. M (2011). "Hydroponics"- a novel alternative for geoponic cultivation of medicinal plants and food crops. *International Journal of Pharma and Bio Sciences*, 2-1,

Myron L company, Application bulletin Hydrophonics,1-2, (2008).

Sweet sorghum: an alternative for bio ethanol production

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Abstract

Sorghum is an important cereal in the semi-arid tropics termed as ''the sugarcane of the desert'' or ''the camel among crops'' due to its drought hardy characteristics. It is mainly divided in three categories, grain sorghum for food, feed and fodder purpose, forage sorghum mostly for green and dry forage and sweet sorghum for sugar and bio-fuel purpose. It is clear that fuel ethanol from sweet sorghum is the best choice to be implement under semi arid tropics and hot and dry climatic conditions because, it has higher tolerance to drought, water logging and salt. Its energy output is higher than sugarcane, sugar beet and corn. The Supreme Court of India informed the Government of India to use CNG as an alternative to petrol and diesel for fuelling automobiles to reduce environmental pollution and the GOI has made it mandatory to blend petrol and diesel with up 5-10 %. The underutilization of the existing molasses-based ethanol distilleries and the deficit in ethanol requirement can be made good if sweet sorghum cultivation is promoted for ethanol production. Therefore, it seems that sweet sorghum is the most suitable crop for biofuel production in India.

Sorghum (*Sorghum bicolor* (L) Moench) is the fifth important cereal crop in the world after wheat, rice, maize and barley. It is mostly grown in the semi-arid tropics (SAT) of the world. Sorghum occupies an area of 6.25 million hectares with a production of about 5.98 million tonnes and yield of 957kg ha^{-1} in India (Anonymous 2012). In terms of area, India is the largest sorghum grower in the world followed by Nigeria and Sudan. India is the third largest producer after USA and Nigeria. It is a C4 herbaceous annual grass that is cultivated from the seed, and is known by various names like great millet and guinea corn in West Africa, kafir corn in South Africa, durra in Sudan, mtama in Eastern Africa, jowar in India, kaoliang in China and milo or milo-maize in the United States (Purseglove 1972). It has wide flat leaves and a round or elliptical panicle with full of grain at maturity. The plant accumulates high concentrations of soluble sugars (10–15 %) in the plant stalk sap or juice. It is a crop of high universal value since it can be cultivated in tropical, subtropical, temperate, and semi-arid regions as well as in poor quality soils of the world. It is termed as ''the sugarcane of the desert'' or ''the camel among crops'' due to its drought hardy characteristics (Sanderson et al. 1992). The crop

can be grown in a wide range of climatic conditions. Whole plant of sorghum can be utilised in industry. Stover can be utilised mainly as cattle feed, in ethanol production and in paper industry, while grain can be used in food, animal and poultry feed and alcohol industries. Sorghum is becoming popular as health food (Fig. 1).

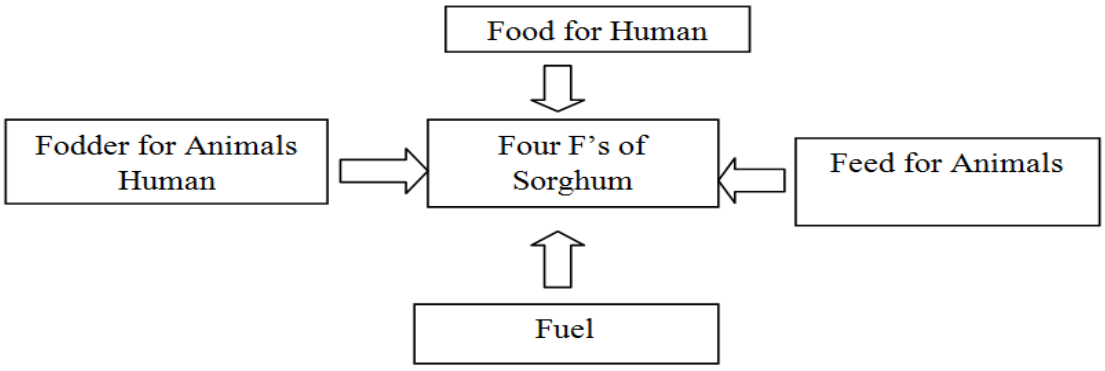

Fig. 1: Uses of Sorghum

Sorghum grain being cheap source of starch is also utilised in preparation of bakery items, in chemical like dextrose, maltose, high fructose syrups, citric acid, lactic acid and sorbitol, and pharmaceuticals, etc. Stubbles can be utilised as animal feed, provided the HCN content is under control. The Stover demand in dairy will be most important followed by poultry and animal feed. These many end uses depend on both chemical composition and physical parameters of the starch granules produced by photosynthesis in cereal seeds.

SWEET SORGHUM USE AS BIO ETHANOL CROP

The term sweet sorghum is used to distinguish varieties of sorghum with high concentrations of soluble sugars in the plant stalk sap or juice compared to grain sorghum which has relatively less sugar and juice in the stalks. Sweet sorghum is a C4 plant species having wide flat leaves and a round or elliptical head with full of grain at the stage of maturity. It is, like grain sorghum, traditionally under cultivation for nearly 3000 years. It can be grown successfully in semi-arid tropics, where other crops fail to thrive and are highly suitable for cultivation in harsh dryland growing areas. With irrigation, it can produce very high yields. During very dry periods, sweet sorghum can go into dormancy, with growth resuming when sufficient moisture levels return. Sweet sorghum is mainly cultivated for syrup and forage production. Sweet sorghum or more appropriately called sweet stalk sorghum is a biofuel crop that accumulates sugars (10-15%). The compositions of Sweet Sorghum are given in table 1 and fig. 2). It is similar to sugarcane, but it also produces grains like normal food or feed types of sorghum. Ethanol is produced from sweet sorghum stem juice through fermentation technology as similar with molasses based process using same infrastructure used for sugarcane industry. Further, the juice can be boiled to make sugar syrup with 70–80 % Brix to be used as table syrup or bio fuel. Besides having rapid growth, high sugar accumulation,

and biomass production potential, sweet sorghum has wider adaptability. Today, sweet sorghum is making its second debut as a highly versatile feedstock that can be used for food, fodder, fuel and animal feed. The bagasse, remnant stalk after extraction of juice, can be used as animal feed or for vermin composting to generate power. It is the only crop that provides grain and stem that can be used for sugar, alcohol, syrup, jaggery, fodder, fuel, bedding, roofing, fencing, paper and chewing. It has been used for nearly 150 years to produce concentrated syrup with a distinctive flavour. Sweet sorghums have also been widely used for the production of forage and silage for animal feed. The oil crisis of 1973 and 1976 renewed interest in the commercial production of sweet sorghum for biological transformation into ethyl alcohol for use as fuel or fuel additive. The crop has the ability to adapt to various agro-climatic conditions and reasonably tolerates drought and saline-alkaline conditions. It is also known as the sugarcane of the desert and also "the camel among crops" for its drought hardy characteristics. It has higher drought tolerance and water use efficiency (WUE) compared to maize, and yields, like those of miscanthus, range from 18 to 36 dry t ha–1 of biomass per year on low-quality soils with minimal inputs of fertilizer and water. In Indiana, studies show that sweet sorghum cultivars produce 25 to 40 tons of dry mass per hectare with 0 to 60 Kg ha-1 of nitrogen fertilizers. The high WUE and low N requirements of sorghum also provide significant advantages to the growers, because sorghum fits into a normal rotation scheme with corn and soybeans, yet has lower production costs and employs similar production equipment and ratooning ability enables multiple harvests per season. The sweet sorghum value chain basically involves four critical areas i.e. feed stock supply, sugars conversion, bio energy (ethanol blended gasoline) distribution and use (Fig. 3). In a feedstock like sweet sorghum, whole plant, its products and by-products are used for diverse purposes. The alcohol productions of different crops are given in Table 2.

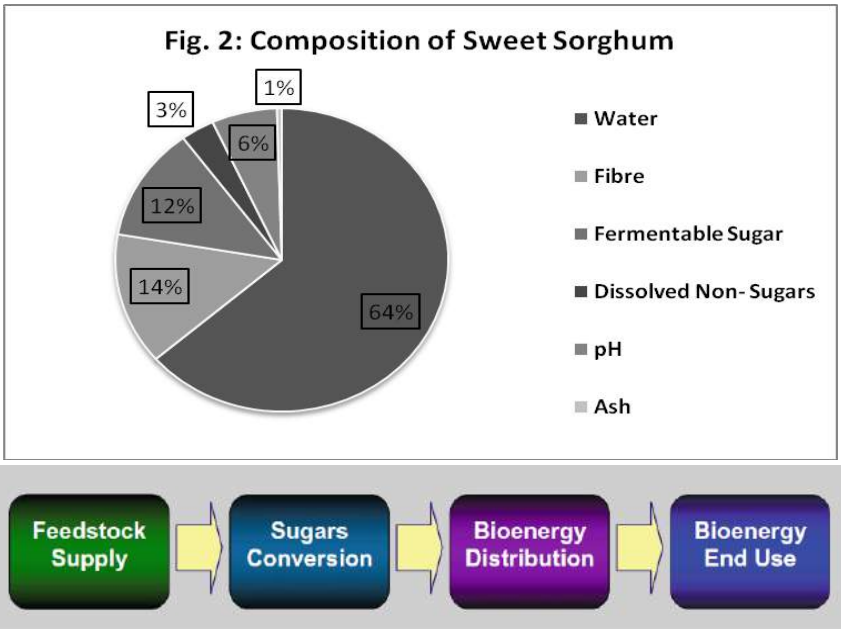

Fig. 3: Critical areas in sweet sorghum ethanol value chain (Srinivasa Rao et al. 2009)

Table: 2.Alcohol yield of selected crops

Sr. No,	Crop	Crop yield per ha (tones)	Alcohol yield per ha (liters)
1	Sugarcane	54.2	3630
2	Sweet sorghum	46.5	3554
3	Corn	5.7	2200
4	Cassava	11.9	2137
5	Grain sorghum	3.5	1362
6	Wheat	2.1	773

COMPARATIVE ADVANTAGES OF SWEET SORGHUM TO OTHER CROPS

In recent years, there has been increased interest in the utilization of sweet sorghum for ethanol production in India. Sweet sorghum is raised from seed and is of shorter duration (115-120 days) than sugarcane (12-18 months) making it amenable for multiple cropping systems. Water requirement of this crop is one-third that of sugarcane on a comparable time scale. Also, sweet sorghum requires about 22% less water than maize. It has more total sugars in the juice of mature plant than sugarcane. The cost of cultivation of sweet sorghum is three times lower than that of sugarcane. Further, sweet sorghum is best suited for ethanol production because of its higher total reducing sugar content and poor sugar content compared to sugarcane juice. With these advantages, sweet sorghum is a good bioenergy crop and can complement the available feedstocks for biofuel production. It is a food fuel-energy-industrial crop, which requires low water/fertilizer input, has a high yield of grains and biomass and grows well in marginal lands. These reasons make sweet sorghum the best alternative source of raw material that can be used as a supplementary raw material rather than as a substitute to ethanol production in India. The advantages of sweet sorghum as a promising source of ethanol than other crops are given in Table 3.

Table: 3 Comparison of sweet sorghum with other bio ethanol producing crops

Characteristics	Sugarcane	Sugar beet	Corn	Sweet sorghum
Crop duration	12 - 13 months	5-6 months	3-4 month	4 months
Growing season	one season	one season	all seasons	all seasons
Propagation	Setts (40000 ha-1)	Seed (3.6 kg ha-1; pellet)	seed (25 kg ha-1)	seed (8 kg ha-1)
Water management	36000 m3 ha-1)	18500 m3 ha-1	12000 m3 ha-1	8000 m3 ha-1)
Fertilizer requirement	250 to 400 N 125P -125K	120 N-60P-60K	130 N-60 P-60 K	80 N-40 P
Stalk/ beet/ grain Yield	60-85 t ha-1	85-100 t ha-1	5-10 t ha-1	45-65 t ha-1
Sugar content on weight basis	10 – 12%	15 – 18%	-	7 – 12%
Sugar yield	5-12 t ha-1	11.25-18 t ha-1	-	3-7 t ha-1
Ethanol yield	4350-7000 t ha-1	7100- 10500 t ha-1	2150-4300 t ha-1	2475- 3500 t ha-1

Table 4: Ideal Characters of Sweet Sorghum

Sr. No.	Characteristics	Range
1	Days to flowering	75 –85 days
2	Days to maturity	100 –115 days
3	Plant height	280 –340 cm
4	Average cane weight	380 –528 g/plant
5	Cane yield	35 –50 t/ha
6	Grain yield	17 –28 q/ha
7	Juice extractability	40 –50 %
8	Brix	16°–19°
9	Total soluble solids	13 –15.2%
10	Reducing sugars	1.3 –2.1 %
11	Sucrose	9.6 –13.6 %
12	Ethanol yield	2500 –4000 lit/h

R & D EFFORTS AND RELEASED VARIETIES AND HYBRIDS OF SWEET SORGHUMIN INDIA

Sweet sorghum research in India is carried out at Nimbkar Agricultural Research Institute (NARI) from 1970s. This institute is situated in western Indian State of Maharashtra. It has been one of the pioneers who initiated sweet sorghum research in India, DSR, Hyderabad and AICSIP centers viz., Rahuri, Parbhani, Akola, Surat, Coimbatore and Dharwad have been engaged in sweet sorghum research since 1989. The sweet sorghum varieties and hybrids bred at DSR, Hyderabad, have the ability to produce extremely high fresh stalk and juice yields (Table 5).

WHY TO NEED ALTERNATE CROP FOR PRODUCTION OF BIO ETHANOL

Bio ethanol used as a petrol substitute and is mainly produced by the sugar fermentation process, although it can also be manufactured by the chemical process of reacting ethylene with steam. The main sources of sugar required to produce ethanol come from fuel or energy crops viz., Sugarcane, sugar beet, corn, wheat and sweet sorghum. Thus it comes from a renewable resource i.e. crops and not from a finite resource. Ethanol or ethyl alcohol (C2H5OH) is a clear colourless liquid; it is biodegradable, low in toxicity and causes little environmental pollution if spilt. By blending ethanol with gasoline we can also oxygenate the fuel mixture so it burns more completely greenhouse gas emissions will be reduced as the fuel crops absorb the CO2 they emit through growing. Blending bio ethanol with petrol will help extend the life of engine and also increase the rural economy by boosting the bio energy crops. Bio ethanol is also biodegradable and far less toxic then fossil fuels. In addition, by using bio ethanol in older engines can help reduce the amount of carbon monoxide produced by the vehicle thus improving air quality. As per the importance of bio ethanol the Supreme Court of India informed the Government of India (GOI) to use Compressed Natural Gas

(CNG) as an alternative to petrol and diesel for fuelling automobiles to reduce environmental pollution. The GOI has made it mandatory to blend petrol and diesel with ethanol (to reduce carbon monoxide emission in automobiles) initially up to 5% and gradually hiking it to 10% in the second phase for reducing both the environmental pollution and the fuel-import bill for the country. According to the Federation of Indian Chambers of Commerce and Industry (FICCI), India could save nearly 80 million L of petrol annually if petrol is blended with alcohol by 10%. Burning quality of alcohol-blended petrol is more eco-friendly than that of CNG. The requirement of ethanol in India to blend with petrol (10%) is about 1000 million L, and for blending with diesel (5%) another 3000 million L per annum. Total ethanol requirement including other purposes is 5000 million L per annum. The possible ethanol production from available sugarcane molasses (8.2 million t) and other sources is 2000 million L per annum. This leaves a deficit of 3000 million L of ethanol per annum. Further, the molasses-based ethanol distilleries operate only for 180 days (during sugarcane crushing season) because of the limited availability of the molasses to run the distillery throughout the year as well as the problems associated with the spent wash to comply with pollution control standards. The existing distilleries therefore, operate at 50% efficiency and needs alternate raw material(s) to operate at their full efficiency. The underutilization of the existing molasses-based ethanol distilleries and the deficit in ethanol requirement can be made good if sweet sorghum cultivation is promoted for ethanol production.

ETHANOL PRODUCTION FROM SWEET SORGHUM

Ethanol can be produced from biomass by the hydrolysis and sugar fermentation processes. Biomass wastes contain a complex mixture of carbohydrate polymers from the plant cell walls known as cellulose, hemi cellulose and lignin. In order to produce sugars from the biomass, the biomass is pre-treated with acids or enzymes in order to reduce the size of the feedstock and to open up the plant structure. The cellulose and the hemi cellulose portions are broken down (hydrolyzed) by enzymes or dilute acids into sucrose sugar that is then fermented into ethanol. The lignin which is also present in the biomass is normally used as a fuel for the ethanol production plants boilers. There are three principle methods of extracting sugars from biomass. These are concentrated acid hydrolysis, dilute acid hydrolysis and enzymatic hydrolysis (Fig. 4).

Table 5. Promising sweet sorghum cultivars (hybrids/varieties) in India

Sr. No-	Entry	Developed by	Pedigree	Days to flowering	Days to maturity	Plant height (cm)	Fresh stalk yield (t ha-1)	Juice yield (kl/ha)	Sugar yield (t/ha)	Cal. Ethanol yield (L/ha)	Grain yield (t/ha)
1	SSV 74	UAS Dharavad	Selection from PAB 74	76	115	360	40.5	16.8	2.77	1000	2.12
2	SSV 84	ACSIP,Rahuri in 1992	Selection from IS 23568	84	124	280	35-40	12-14	1.66	1000-1100	1.29
3	CSV 19SS	ACSIP,Rahuri in 2005	RSSV 2 x SPV 462	78	120	330	35-40	12-14	1.59	1000	1.23
4	CHS 22SS	DSR Hyderabad in 2005	ICSA 38 x SSV 84	82	119	350	44-52	14-18	2.14	1100-1300	1.60
5	CSV 24SS	DSR Hyderabad in 2011	NSS 1005A x (SSV 84 x 401B)	81	119	300	35-40	14-15	1.63	1100-1200	1.20

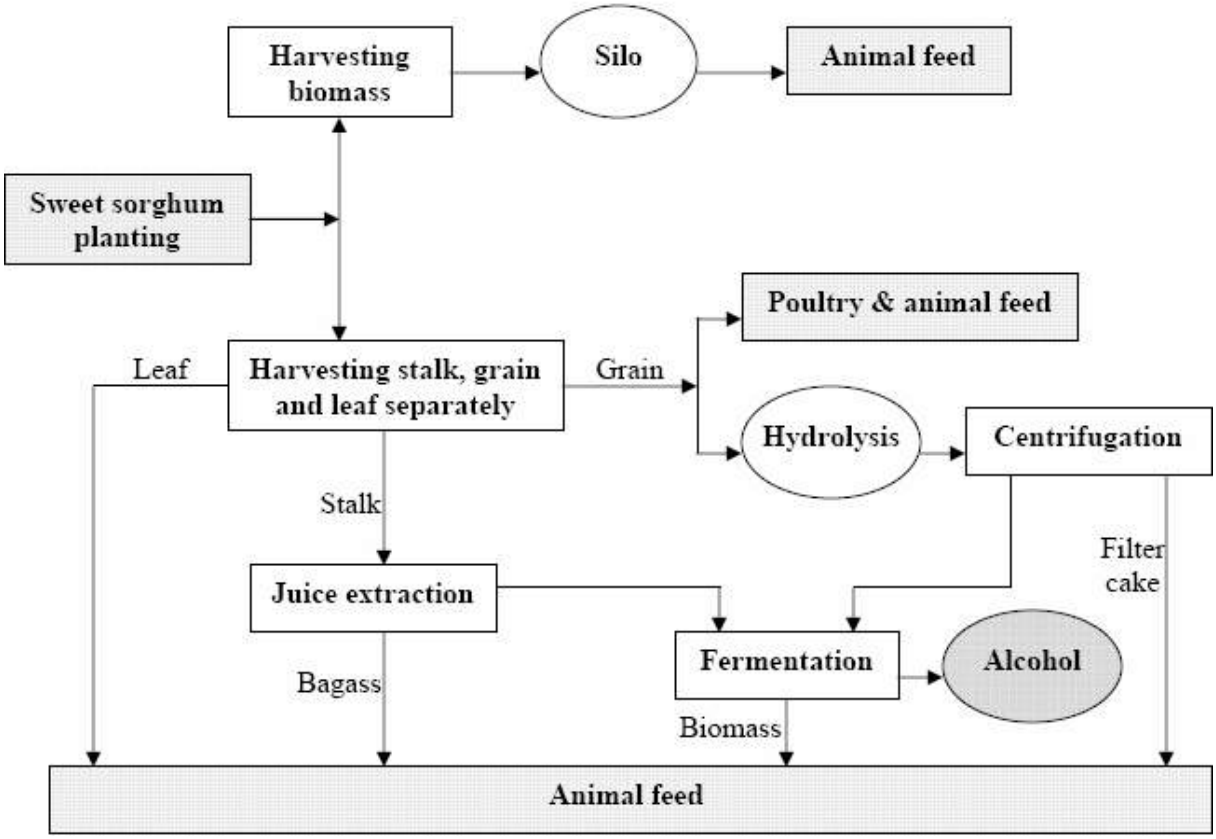

Fig. 4: Proposed layout for ethanol production and by-product from sweet sorghum (Adopted from Almodares and Hadi 2009)

CONCLUSION

It is clear that fuel ethanol from sweet sorghum is the best choice to be implement under semi arid tropics and hot and dry climatic conditions regarding both economic and environmental considerations. Because, sweet sorghum has higher tolerance to drought, water logging and salt. It may be harvested 3-4 months after planting and planted 1-2 times a year. Its energy output/fossil energy input is higher than sugarcane, sugar beet and corn. It is more water use efficient (1/3 of water used by sugarcane at equal sugar production). Its production can be completely mechanized and its bagasse has higher nutritional value than the bagasse from sugarcane when used for animal feeding. Also, by implementing agricultural practices such as adequate water and fertilizers, suitable cultivars or hybrids, crop rotation, pest management and etc., can increase productivity with focus on biofuel production. In addition, sweet sorghum has high amount of sucrose and invert sugar which are easily converted to ethanol. The Supreme Court of India informed the Government of India to use CNG as an alternative to petrol and diesel for fuelling automobiles to reduce environmental pollution and the GOI has made it mandatory to blend petrol and diesel with up 5-10 %. Molasses the traditional source of raw material for ethanol production, is unlikely to meet the actual demand therefore needs of alternate raw material(s) to operate at their full efficiency. The underutilization of the existing molasses-based ethanol distilleries and the deficit in

ethanol requirement can be made good if sweet sorghum cultivation is promoted for ethanol production. Therefore, it seems that sweet sorghum is the most suitable crop for biofuel production in India.

REFERENCES

Anonymous (2012): Directorate of Economics and Statistics, Department of Agriculture and Cooperation. Govt. of India.

Purseglove JW (1972): Tropical crops: monocotyledons, vol 1. Longman Group Limited, London, p 334.

Sanderson MA, Jones RM, Ward J, Wolfe R (1992): Silage sorghum performance trial at Stephenville. Forage Research in Texas. Report PR-5018. Texas Agricultural Experimental Station, Stephenville, USA.

Srinivasa Rao P, Rao SS, Seetharama N, Umakanth AV, Sanjana Reddy P, Reddy BVS, Gowda CLL (2009): Sweet sorghum for biofuel and strategies for its improvement. International Crops Research Institute for the Semi-Arid Tropics, Patancheru. Information Bulletin No. 77. 80 pages. ISBN 978-92-9066-518-2.

Almodares A And Hadi MR (2009): Ethanol production and by-product from sweet sorghum. African Journal of Agricultural Research,4 (9):772-780.

Agribusiness: A Vehicle for Inclusive Growth

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Abstract

Inclusive growth is broad based equitable distribution of economic gains to society. Inclusive growth (IG) refers both to the pace and pattern of growth, which is considered, interlinked, and therefore in need to be addressed together. Agribusiness is a sector which has more scopes for inclusive growth. The main aspects of the enabling agribusiness environment in India are playing their own roles in enabling it as a vehicle for inclusive growth. Agribusiness is the off-farm link in agro-food value chains. There is an urgent need to have a long-term vision for agriculture and farmers for inclusive growth.

INTRODUCTION

"Inclusive growth is a worthwhile end is towards which we should work and which should be pursued in conjunction with economic gains."

The 11th Five Year Plan is clear: *inclusive growth yields broad based benefits and ensures equal opportunities for all.* Inclusive growth is broad based equitable distribution of economic gains to society. Investing in inclusive growth will enhance human capacities, produce a quality work force, and build a strong knowledge base. The inclusive growth approach takes a longer term perspective as the focus is on productive employment rather than on direct income redistribution, as a means of increasing incomes for excluded groups. In the short run, governments could use income distribution schemes to attenuate negative impacts on the poor of policies intended to jump start growth, but transfer schemes cannot be an answer in the long run and can be problematic also in the short run. Inclusive growth (IG) refers *both* to the pace and pattern of growth, which is considered, interlinked, and therefore in need to be addressed together. The idea that both the pace and pattern of growth are critical for achieving a high, sustainable growth record, as well as poverty reduction, is consistent with the findings in the *Growth Report: Strategies for Sustained Growth and Inclusive Development* (Commission on Growth and Development, 2008). IG

focuses on productive employment rather than income redistribution. Hence the focus is not only on employment growth but also on productivity growth.

Agricultural growth is a major means of including poor people in growth. Without higher agriculture growth, India's 10% economic growth target will be impossible to achieve. In addition, higher real incomes lead to higher food consumption, implying more pressure on demand. Agribusiness is a sector which has more scopes for inclusive growth. The government should look upon agribusiness as one of the ways for the inclusive growth as emphasized in the 11th Five Year Plan.

"Recognition that certain types of growth are poverty reducing is important to discipline public expenditures. It would be unfortunate if this government's view of inclusive growth is confined to welfare programmes." - Bharat Ramaswami

INCLUSIVE GROWTH AND INDIA

India's post 1990's economic growth has made it one of the world's fastest growing economies in the world. Its GDP growth rates of up to about 9% in the last few years are historically unparalleled except by the neighbouring China. With the rapid growth rates, however, come new challenges and new questions. One such challenging question concerns the spread of the benefits of growth across different segments of society.

To ensure that growth has been well distributed, India's Planning Commission has made Inclusive Growth their explicit goal in the eleventh five-year plan. At micro level, evidence suggests that improving the following factors will help accelerate poverty reduction: reduction of inequality, not limited to income inequality, access to public infrastructure and services especially health and education, access to markets, accountability and voice, good governance, and the role of civil society organizations, women empowerment.

AGRIBUSINESS SCENE IN INDIA

Nature has been very good to India. India has 52 percent of total cultivable land as against 11 percent in the world. All 15 major climates of the world from snow-bound Himalayas to hot humid southern peninsula and the Thar Desert to heavy rain areas exist in India. There are 20 agro-climatic regions and nearly 46 out of 60 soil types in the country. Sunshine hours and day length are ideally suited for round the year cultivation of crops. India is the centre for biodiversity in plants, animals, insects, micro-organism and accounts for 17 percent animal, 12 percent plants and 10 percent fish genetic resources of the globe. Using the above comparative advantages, India has been the second highest fruit and vegetable producer in the world, second highest producer of milk with a cold storage capacity of 70,000 tonnes, fifth largest producer of eggs, and the sixth largest producer of fish with harvesting volumes of 5.2 million tonnes.

However, the exports from India are poor. Compared to other countries the land productivity in India is low. Even with in the country, there are tremendous variations among the states in terms of farm productivity. There is a tremendous scope for increasing the farm outputs using state of the art pre-harvest

technologies and harvesting techniques. Value added agriculture has not yet caught on with-in the Indian scene. Post-harvest technologies are at a nascent stage in India. Pre-cooling, cold chain, packaging and transport using totes or small containers are all absent, resulting in substandard delivery of groceries and enormous amounts of wastage.

India is a one of the leading producer of agricultural and livestock commodities – grains, fruits and vegetables, milk, etc. However the share of these products going for processing is very small. Also, India's share in world trade of processed food is 1.6%, and value addition is 20% (Ministry of Food Processing, Annual Report 2005-06).

THE MAIN ASPECTS OF THE ENABLING AGRIBUSINESS ENVIRONMENT IN INDIA

1. Changes in Socio Economic Environment

Like the emerging situation in several developing countries changes in the socio economic environment is leading to higher demand for processed foods. This change is characterized by urbanization, higher incomes, less time available for cooking, increasing globalization and exposure to global markets, increasing number of nuclear families. Another aspect of the socio-economic change is the increase in the number of supermarkets and organized retailing in India.

2. Changes in Policy Environment

Following liberalization in 1991, government followed a liberalised overall policy regime, with specific incentives for high priority food processing sector to provide a conducive environment for investments and exports in the sector. The government has accorded a high priority to the food processing sector to encourage commercialisation and value addition to agricultural produce; for minimising pre/post harvest wastage, generating employment and export growth. Recognizing that a robust and dynamic food processing sector is to play a vital and stellar role in the new emerging global economy, all policies and plans for the food processing industries is coordinated by the Ministry of Food Processing Industries.

3. Credit and Finance

Though several steps have been taken to enhance credit availability in the past few years, the Union Budget for financial year 2006-07 was hailed as the first-ever Union Budget that has focused attention on food processing and food technology. Major recommendations include – use of ware house receipts, amendments in priority sector lending, restructuring government schemes, modifying evaluation parameters by banks/financial institutions (MOFPI, 2005)

4. Emphasis for Infrastructure Development

Upgrading infrastructure for food processing, is a key priority for the Ministry of Food Processing. Several initiatives for upgrading the infrastructure are presented in the Annual Report of the Ministry of Food Processing Industries, 2005-06.

5. Supporting Institutions

Several supporting institutions and mechanisms have been put in place to meet the changing needs of the agro processing sector – enhancing farmer information about markets and modern

farming practices, developing linkages with private sector, providing venture capital, providing support for exports, etc.

AGRIBUSINESS AND INCLUSIVE GROWTH

A dynamic private agribusiness sector linking farmers and consumers can be a major driver of growth in the agricultural and the rural nonfarm sectors. But growing agribusiness concentration may reduce its efficiency and poverty reduction impacts. A better investment climate for small and medium enterprises can improve competitiveness. Targeted public-private sector partnerships and corporate social responsibility initiatives are instruments to promote smallholder participation. Agribusiness is the off-farm link in agro-food value chains. It provides inputs to the farm sector, and it links the farm sector to consumers through the handling, processing, transportation, marketing, and distribution of food and other agricultural products.1 Thus, there are strong synergies between agribusiness and the performance of agriculture for development. Dynamic and efficient agribusiness spurs agricultural growth. And a strong link between agribusiness and smallholders can reduce rural poverty. Agribusiness has a large and rising share of gross domestic product (GDP) across developing countries.

In recent years, influenced by changes in consumer demand and rapid technological and institutional innovations, the structure of agribusiness has changed dramatically and its performance has been highly dynamic. Two major challenges need to be addressed in considering the role of agribusiness for development: Market forces do not guarantee competitiveness, nor do they guarantee smallholder participation, both essential to link agricultural growth to development. For these reasons, promoting competitiveness and enhancing smallholder participation are two priorities of the agriculture- for-development agenda. The two complement each other as competitive small and medium agro enterprises in rural areas can link smallholders to value chains and urban demand.

Agro enterprise development can increase competitiveness by favouring entry of small and medium enterprises (SMEs) and facilitating the inclusion of smallholders. According to the above discussion points, agribusiness could be a valuable vehicle for inclusive growth. The Self Help Groups (SHGs) are mushrooming with high success in India. The weaving of SHG activities around agribusiness creates more inclusion leading to inclusive growth. From the development perspective, critical issues for inclusive and equitable growth are involvement of small and marginal farmers in value chains, linking farmers to markets and other initiatives such as “Rural Business Hub”, formation of “producer companies” will contribute to linking farmers to markets. The processing is in the unorganized sector, enabling this sector to meet the requirements of the new food safety laws is critical to link them to the modern system. In addition to this, balanced regional growth throughout the country is also important so that each area gets a

fair chance to share the benefits of this metamorphosis.

Indian food-processing sector is undergoing rapid transformation. As the economy of the country moves on the path of development, agricultural sector evolves from traditional subsistence level farming to commercial agriculture producing high value and processed products. There is high potential demand in the domestic as well as export market. On the supply side, with vast arable land and agro-climatic diversity, India has the potential to be a food basket of the world. With this interaction of demand and supply forces the food processing sector has the potential to be the driver of economic growth and enhance rural incomes. Food Processing Industry is widely recognized as a 'sunrise industry' with a vision to make India the Food Basket of the world, achieves what has been achieved in the field of computer technology.

While steps have been taken in the right direction, the critical issues in the way forward are inclusive and equitable growth by ensuring participation of small and marginal farmers, backward areas and regions and small and micro enterprises in the value chains. It has been observed in various developing countries around the world that benefits of the modernizing sector do not automatically accrue to all stakeholders in the system. Particularly at risk are small scale farmers, faced with increasingly strict agro-industry standards and contractual arrangements, and small scale traders, processors, wholesale markets and retailers, who must compete with large food suppliers and manufacturers.

Recognizing the importance of agro industry development in enhancing rural incomes and agribusiness development with inclusive growth it has become clear worldwide that the most rapid growth in agriculture has for quite some time been occurring in post-production activities. This is in large part being driven by the growing number of middle income consumers even in lower income countries and their demands for better quality value-added products. Agri-food systems world-wide are increasingly being dominated by vertically coordinated, if not vertically integrated, organizations. High concentration and vertical co-ordination of agri-food systems is already a reality in high income countries.

Negligible presence of agro-industry and agribusiness resulting in low level of value addition of agricultural commodities has been one of the main causes for stagnation in rural incomes. Conversely, an analysis across countries and regions, substantial agribusiness sector generating high value addition to the outflow of goods, correlate with a higher level of agricultural GDP and rural incomes. Thus, with increasing incomes, agribusiness development is inevitable. Now only thing required is to make sure that all the stake holders are treated in an equitable and fair manner.

While there are some of the short-term measures that may be essential, there is an urgent need to have a long-term vision for agriculture and farmers for inclusive growth. And that includes a strategy for improving the profitability of agriculture. This is not only essential for maintaining the growth rate of the

economy but is necessary if there has to be any meaning to the agenda of inclusive growth. How can one think of inclusion if more than half the population is excluded from the growth process?

CONCLUSION

India's next frontier of innovation is in the area of agribusiness and agro processing. Food processing industry is widely recognized as a 'sunrise industry' in India having huge potential for uplifting agricultural economy which has been stagnant in the past few years, exposing traditional Indian agriculture to modern technologies, creating large scale processed food manufacturing and food chain facilities and consequently generate employment and export earnings. If farmers have to remain efficient and get viable incomes, farm profitability should be clearly focused and enhanced.

This calls for action from several players. Critical issues on the development front include ensuring participation of small and marginal farmers in modern value chains. This can be done by undertaking projects for linking farmer to markets. The competitive environment for the large number of small and micro enterprises is changing because of increasing competition with large companies and multinationals. Income generation is an entrepreneurial activity. Less State and more private involvement could provide suitable conditions for enhancing farm incomes.

REFERENCES

Andrew Shepherd, "*Approaches to linking produces to markets: A review of experiences to date",* Agricultural Management, Marketing and Finance, Occasional Paper, Food and Agricultural Organization of the United Nations, Rome, 2007

Ministry of Food Processing Industries, *Annual Report of Ministry of Food Processing of India 2005-06*, New Delhi, India

Commission on Growth and Development (2008) *Growth Report: Strategies for Sustained Growth and Inclusive Development*, the World Bank.

Dollar, D. and A. Kraay (2002) "Growth Is Good for the Poor." *Journal of Economic Growth* 7, pp. 195–225.

Esperanza I. Cabral, M.D., (2008) 'Creating Opportunities for More Inclusive Growth', *Working Group on the MDGs and Social Progress*, Plenary Session I, March 2008.

Srinivasan N., (2007) 'Profitability in Agriculture and Inclusive Growth', *Cab Calling*, January-March, 2007

Forbes, K. (2000), "A Reassessment of the Relationship between Inequality and Growth." *American Economic Review*.

Singh S., (2008) 'Time for Agriculture to Metamorphose in Agribusiness', *Newsletter of College of Agribusiness Management*, GBPUAT, Pantnagar, in Vol. 06, No. 03, July to September 2008.

http://chronicpoverty.wordpress.com/2009/11/17/inclusive-growth-in-india/

http://online.wsj.com/article/SB126698787056350691.html?mod=WSJ_latestheadlines

http://www.rediff.com/money/2006/jan/21guest1.htm

http://indiamicrofinance.com/blog/agribusiness/growing-hope-for-india%E2%80%99s-farms-the-agribusiness-scenario-in-india.html
http://www.livemint.com/2009/07/06211328/Rural-welfare-an-exclusive-vi.html
http://www.livemint.com/2010/02/17230546/True-inclusive-growth-requires.html

Interventions to Produce Woman Agriprenuers:

Another Feather of Success to Agricultural Community

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These are the success stories of Krishi Vigyan Kendra, Kalahandi, Orisha

MUSHROOM PRODUCTION:
A PROFITABLE ENTERPRISE

In the present era, farm women play a vital role in Indian agriculture. They are no more subordinate to their male counterpart but they rather complement them in their agricultural activities. The attention is always been focused on development of women in agriculture because there is much more opportunities for women to make themselves independent by engaging themselves in various agriculture related activities. Now days much emphasis is given on enterpreunerial development and mushroom production is one of the rising enterprises due to its heavy market demand and high nutritional value. Ahalya Sahu a middle aged widow from'Malgaon' village of Bhawanipatna block is truly been an example for her locality. Though she is a landless farm women but she had a strong longing to support her family by doing some income generated activities. During a field visit to her village, the scientists of KVK, Kalahandi came to know about the interest of the farm women to engage

themselves in some income generated activities. The scientists advised the farm women to go for mushroom production, as the village is close to town so there will be hardly any difficulty in getting the spawn and marketing of the produce.

Mushroom training was organised in the village and the KVK scientists demonstrated the preparation of mushroom bed (Both paddy straw and oyster) which includes size of the paddy straw, technique of preparing bed, spreading of spawn in each layer of the bed, moisture and temperature

maintenance, method of harvesting and marketing etc. Being trained on mushroom cultivation, she thought this technology can be a source of income as she can devote some hours in this activity with her daily household chores. Initially on experimental basis she tried 1 or 2 bed and after getting the result and calulating the benifit associated with it, she started putting more no. of beds and last year she put 1000 beds in oyster mushroom and 600 beds in paddy straw mushroom. She is really been profited by this as it is home based enterprise, one does not need to go outside. It is very cost effective and does not require a big amount, which can be easily affordable by everyone.

The cost of cultivation for one Paddy straw mushroom bed is around Rs.40/- and the gross return is Rs.100/- bed. The B: C ratio of Paddy straw mushroom is 2.5:1 where as in Oyster mushroom the cost of cultivation per one oyster bed is Rs. 30/- and gross return is RS. 100/-. The B: C ratio is Rs.3.3:1. Seeing the profit associated with this enterprise she has constructed a low cost shade house for mushroom production.

By practising this enterprise, she has earned a profit of around Rs.1, 06,000/- annually. Now she has become a source of encouragement for others in her locality. She has been recognized as a mushroom grower in the district. She feels herself proud being independent women managing her small family through her income and express that she will carry this enterprise and teaches other fellow women the method to cultivate mushroom. Seeing her success the women mass in her locality has also stared this enterprise. This technology has spread horizontally in 350 no. of farmers.

SRIMATI DHARITRI PRADHAN- A SUCCESSFUL LADY FARMER OF FLORICULTURE

Background information

Kantamal of Kesinga block is an adopted village of KVK, Kalahandi. It is situated twenty five kilometers away from Bhawanipatna. Villagers of Kantamal are generally resource poor & usually they grow cotton & paddy as their main crop. 25 years old Srimati Dharitri Pradhan wife of Sri Suryamani Pradhan is an innovative farm woman of this village. Being an intermediate by qualification, she was actively involved in cultivation of cotton, paddy, arhar, greengram, blackgram etc

with her husband. They own 6.0 acres of land which is a major source of their earning. She was also taking up floriculture in a small patch of land near her residence, as part of her hobby.

KVK intervention in suggesting enterprise

While doing PRA survey during 2007-08 in Kantamal village, scientists of KVK met Smt. Pradhan and her family. Being an qualified women she was not interested to go to the paddy or cotton field. Rather she was in search of doing something which is interesting, labour saving and will supplement to her family income. Looking to her interest and aesthetic sense as well as observing the marketability & profitability, KVK scientists suggested her to adopt floriculture in a commercial basis which was easily accepted by her.

Capability building in undertaking activities

KVK as per its mandates organized some capacity building activities through various training programmes and on farm demonstrations in Kantamal village. Smt. Pradhan attended all these programmes and became aware about the activities of KVK. Then with her personal interest she frequently visited KVK and kept regular contact with the scientists. She was explained and trained with the details of commercial cultivation of rose, marigold, and tuberose. Besides, she was provided technical guidance as and when needed which motivated her to spare about 1.25 acres of land towards floriculture, particularly for cultivation of marigold, rose and tuberose. She followed almost all package of practices advised to her.

Income generated annually from the enterprises:

Smt. Dharitri developed her own nursery and used the seedlings in her main field. Similarly most of the farm works were being performed by herself and her husband with least engagement of outside labourers to minimize the cost of investment. Instead of using huge chemical and fertilizer, she used FYM, oil cakes and traditional plant protective materials. Thus with the overall minimum investment she earned near about Rs.50,000/- during last year and expects more in coming years.

Assets created with the generated income:

From this earning she presented a motor cycle and mobile phone to her husband which, she hope will facilitate marketing of cultivated flowers.

Problem encountered in the vocation and solutions:

a. Difficulties in getting loan from commercial banks due to joint family system.
b. Unavailability of labourers for timely cultural operation.
c. Cost of labour is too high.

Her future aspiration:

Realising the better marketing opportunity Smt. Pradhan is interested to take up mushroom cultivation so that the waste material of mushroom production could be utilized for vermicomposting for

ultimate use in her floriculture production. She is also interested for the mechanization of her farm operation in the event of scarcity and high cost of labourer.

SUGGESTIONS IF ANY

Srimati Pradhan has been advised to contact DDH/ Horticulturist to avail financial benefits/ subsidies under National Horticulture Mission to fulfill her future aspiration. She has also been assumed for all technical guidance for mushroom production and development of vermicompost unit by the KVK in near future.

Table No. 1: Participation of rural women in agriculture & allied activities

Agri & allied sector	Women activities
Crop Production	Land Preparation Land Levelling Nursery Raising Transplanting Weeding Watch & Ward Harvesting Threshing Winnowing Cleaning and Storage
Horticulture	Nursery raising Planting Irrigation Composting Fertilizer application Harvesting
Animal Husbandry	Cleaning of Shed Feeding Milking Value Added products
Poultry	Cleaning of Poultry House, Feeding Egg Collection Watch & Ward Marketing
Value addition	Making value addition products like blanching of vegetables
	Rope making Handicrafts, Badi & Pampad Jam & Jelly, Anola supari, etc. Marketing of the value added products
Other activities	Mushroom production Floriculture Anola supari Poultry rearing

Table No. 2: Women activities already undertaken by the KVK

Agri & allied sector	Women activities
Mushroom Production	Cultivation of Paddy straw mushroom Cultivation of Oyster mushroom
Banaraja poultry rearing	
Floriculture activities	Marigold cultivation Gladiolus cultivation
Value added products	Anola Supari Methi powder Sikakai powder Dry forest products, Harida, Bahada & Anola
Deworming of kids	
Implementing of drudgery reducing tools for agriculture activities	Manual Maize sheller Bhindi plucker Manual Sunflower threshing bench

Table No. 3: No. of Women Self Help Group of Kalahandi district:

Sl. No.	Name of the Block	No. of SHG form	No. of members
1.	Lanjigarh	843	8645
2.	Th. Rampur	807	8104
3.	kesinga	756	9217
4.	Bhawanipatna (Rural)	1134	12239
5.	Karlamunda	360	5017
6.	M. Rampur	899	11218

7.	Narla	1083	12212
8.	Bhawanipatna (Urban)	311	3842
9.	Golamunda	769	9554
10.	Koksara	945	11211
11.	Dhrmagarh	820	9431
12.	Jaipatna	804	9977
13.	Junagarh	845	9443
14.	Kalampur	437	4880
	Total	10813	124990

Table No. 4: Population of Kalahandi district:

Total population:	1335494
Male:	667526
Female:	667968
SC population:	236019 (17.76%)
Male:	117344 (17.58%)
Female:	118675 (17.77%)
ST population:	382573 (28.65%)
Male:	188646 (28.26%)
Female:	193927 (29.03%)

Indian Currency Demonetization: Pros and Cons

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The current demonetization policy of Government of India (GOI) is the buzzing topic in every nook and corner of India. Demonetization is done for the overall economic development for India. Demonetization refers to discontinuing of current currency units and replacing those currency units with new currency units. It is a transformational decision taken by the government to ban Rs.500 and Rs.1000 notes from circulation in the market. The decision was taken to minimise the black money and corruption. The RBI will be issuing Rs.500 and Rs.2000 notes from today onwards. They have released a statement by saying that all the Rs.500 and Rs.1000 notes are to be deposited at nearby banks or post-offices. This will be a regular currency circulation all throughout India. All those people who are panicked with this move by the government need not worry at all as the government has assured that 'Your money will be yours. You will not lose anything so there is no point in being scared. There will be no restrictions on non-cash payments by cheques, demand draft's, and electronic fund transfer.

On November 8th, 2016, GOI declared that 500 rupee notes and 1000 rupee notes are invalid. New currencies in denomination of 2,000 and 500 are to replace the old currency. People can exchange the old currency in the banks to new currency up to 4,500 rupees initially till 24th November. People can deposit the old currency in their bank accounts. Deposits above 2, 50,000 rupees need documents and will be taxed according to the newly introduced tax bill in Loksabha on 29th November 2016 by finance minister, Mr. Arun Jaitley. GOI has extended old currency exchange in EB offices, tax offices, petrol bunks etc. till 15th December 2016. In the ATMs, initially 4,000 rupees was allowed to be withdrawn but now only 2,000 is the daily withdrawal limit. GOI aims to make a cashless economy through financial inclusion measures like payment banks, card based transactions, online transactions, internet banking, NEFT, RTGS etc. The mobile applications like Paytm, Mobikwik etc. are advised for online transactions in the current scenario.

The banks have received Rs 11.55 lakh crore as deposits of the demonetized

high currency notes as of Tuesday (on 27th December 2016). Deputy Governor R Gandhi told the media on Wednesday while answering a question. This is 82.5% of the Rs 14 lakh crore that was wiped out overnight when Prime Minister Narendra Modi announced that Rs 500 and Rs 1,000 bank notes would be delegalized as of November 8 midnight. The government was expecting that about Rs 3 lakh crore in bank notes may not come back, wiping out that much black money held in cash within the country. However, according to the central bank, so far Rs 11.55 lakh crore has come back as deposits, a number which is only expected to go higher by December 30. Old Rs 500 and Rs 1,000 notes can be deposited in banks till December 30. The rising level of deposits has raised concerns that hoarders of illicit cash may have found a way to convert their black money into bank deposits. The Enforcement Directorate has opened inquiries in atleast 50 bank branches to check money laundering and hawala transactions.. In the postpolicy media interaction the central bank said that the demonetization move was well thought out and was not a decision made in haste.

Do you think the government is conjuring policies on its own? Well, it is not so. Like every economic and political measure, demonetization also has a valid place in the Indian law books. The legal basis for the order demonetizing currency can be found in **Section 26** of the **Reserve Bank of India Act, 1934**. Under **sub-section (2)** of this Section, the Union **Government is given the power to declare that any notes issue by the Reserve Bank will no longer be legal tender**

Many countries have experimented with the process of demonetization in the past. Some countries benefitted tremendously from the move while some terribly failed at it. Here is a list of some countries that have implemented the policy of demonetization: France , US (1969) ,Britain (1971) , Ghana (1982) , Myanmar (1987) , Nigeria (1984) , Zaire (1990) , Congo (1990), Soviet Union (1991) , Australia (1996) , Zimbabwe , North Korea (2010) & Pakistan (2015).

REASONS OF DEMONETIZATION:

We knew terrorism is a frightening threat, but who funds these terrorists? Our enemies they use the fake currency to sponsor terror-this was proven many a times. Corruption and black money are the major obstacles in our country. It is weakening the efforts to remove poverty. Our country is rapidly increasing in terms of growth and we are in No.1 position in terms of growth but we are ranked 76 in Global Corruption Perception ranking. It clearly shows how corruption and black money have spread their tentacles.

IMPACTS OF DEMONETIZATION:

Inflation: It will cause deflation in the market as people who have earned money through illegal ways would be afraid to declare the money as they may be prosecuted by the Income tax department on the legitimacy of their income.

REDUCTION IN MONETARY CIRCULATION

This will lead to reduction of money circulation in the economy leading to deflation. Value of money will be increasing which we have because the total money supply will be going down but the commodities and things available

in the market have not gone down. It will lead to inflation slowly but not overnight.

Cash Deposits in Banks: A lot of cash which are legally earned will be deposited in the banks and now the banks with more deposits will be able to do more lending.

Easy Loans: Loans will become easier and interest rates may come down. As banks will have more money so more loans will be given out which will increase the money supply in the market and it will create inflation.

ADVANTAGES

It is a major decision and its impacts all the citizens of the country because overnight all the money you have become a piece of paper which has no value if you do not exchange it with new currency units or deposit it in the banks. In order to understand demonetization better let's look at advantages of demonetization. The biggest advantage of demonetization is that it helps the government to track people who are having large sums of unaccounted cash or cash on which no income tax has been paid because many people who earn black money keep that money as cash in their houses or in some secret place which is very difficult to find and when demonetization happens all that cash is of no value and such people have two options one is to deposit the money in bank accounts and pay taxes on such amount and second option is to let the value of that cash reduced to zero. Since black money is used for illegal activities like terrorism funding, gambling, money laundering and also inflating the price of major assets classes like real estate, gold and due to demonetization all such activities will get reduced for some time and also it will take years for people to generate that amount of black money again and hence in a way it helps in putting an end this circle of people doing illegal activities to earn black money and using that black money to do more illegal activities. Another benefit is that due to people disclosing their income by depositing money in their bank accounts government gets a good amount of tax revenue which can be used by the government towards the betterment of society by providing good infrastructure, hospitals, educational institutions, roads and many facilities for poor and needy sections of society.

DISADVANTAGES

The biggest disadvantage of demonetization is that once people in the country gets to know about it than initially for few days there is chaos and frenzy among public as everybody wants to get rid of demonetized notes which in turn sometimes can lead to law and order problem and As one can see from the above that demonetization has both advantages and disadvantages and it is up to the government to see and analyze all the pros and cons and then decide whether it is beneficial to go ahead with demonetization or not. chaotic situation especially in banks and ATMs which are the only medium to change the old currency units to new currency units. Another disadvantage is that destruction of old currency units and printing of new currency new units involve costs which has to be borne by the government and if the costs are higher than benefits then there is no use of demonetization. Another problem is that majority of times this move is targeted towards black

money but if people have not kept cash as their black money and rotated or used that money in other asset classes like real estate, gold and so on then there is no guarantee that demonetization will help in catching corrupt people.Other disadvantages are :-

- It will cause great inconvenience to common man who will start running to bank to exchange Rs.500 and Rs.1000 notes.
- By replacing all the Rs.500 and Rs.1000 denomination notes, as ordered by the government, could cost the RBI at least Rs.12000 crore.
- It will be very difficult for half of the population who are not well versed with the card transactions.
- The major problem is that big fishes will be left out whose black money is in the form of foreign currency, gold and property and stashed in tax havens.

CONCLUSIONS

It may cause inconvenience for initial few days for those who have to start running to the banks to exchange notes, deposit amount or withdraw the same. The situation can turn chaotic if there is a delay in the circulation of new currency. Individuals who have an upcoming wedding are the ones who have to make alternative arrangements to make payments. However, the government has given higher withdrawal limit in such cases. Cost of currency destruction after the news, we have seen that many individuals have burnt their cash and discarded the same, which is a loss to the economy. The government has to bear the cost of printing of new currency and its circulation. It makes sense when benefits of demonetization are higher. Conclusion There is only advantages of demonetization in the long term. The advantages are much dominating and it will be in the long term interest of our country comfortably outweighing the disadvantages. Government need to take all the necessary steps so as to ensure that there will be a smooth flow of currency exchanges. It would turn into chaos if government takes no necessary steps to circulate money correctly. It will make a massive change in our economy. We congratulate the entire government and those hidden brains of our democracy who brought this decisions.

Sensible Use of Soil Nutrients for Crop Production

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SOIL NUTRIENTS- AN INTRODUCTION

Soil is a vital part of the natural environment. It provides habitation for a wide range of plant and organisms and also supplies nutrients to the plant growth. Soil is always responding to changes in environmental factors, along with the influences of man and land use. Some changes in the soil will be of short duration and reversible, others will be a permanent feature of soil development. Soil nutrient content plays a key role in plant growth through mineral nutrition and toxicity. Plants require 16 essential elements to complete their life cycle. Out of them, the 13 mineral nutrients, which come from the soil, are dissolved in water and absorbed through a plant's roots. They are not always enough of these nutrients in the soil for a plant to grow healthy and also to yield high. This is why farmers are applying fertilizers to add the nutrients to the soil. To utilize the available soil nutrients in sensible way for crop growth without affecting sustainability, soil test based fertilizer recommendation is being considered as vital tool.

SOIL TESTING

Soil testing is estimating the nutrient content of the soil through laboratory analysis which is the only practical way to know the soil requirement and also it is a prerequisite for developing an effective nutrient management strategy for enhancing agricultural productivity. In the late 1940s, large-scale use of synthetic N fertilizers led to increased crop yields. As crop nutrient removal increased with these higher yields, soil reserves of certain plant nutrients, particularly P and K, began to be depleted, resulting in nutrient deficiencies and lower yields. In response to these problems, there was a concerted effort to develop soil-testing methods. In addition to major nutrients, secondary and minor nutrients of the soils are also getting depleted due to continuous mining of nutrients through intensive cropping (Singh, 2008). The initial efforts already made were expanded to include soil tests for other plant nutrients, such as calcium (Ca), magnesium (Mg), boron (B), sulphur (S), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn). Soil testing now is widely accepted as a valuable tool that can be used to identify

the economically optimum rates of nutrients required by most crops. In India, it is started during the year 1955-56 with the setting up of 16 soil testing laboratories. Soil testing includes sampling and sample preparation, sample analysis, preparation of fertility maps and indices, interpretation of analytical data and recommendation of fertilizers. Despite accurate and precise analysis in laboratory results may not be meaningful if sampling and sample preparation is not of technical specification. Soil sampling must be scientific and true representative of field under investigation. It is very important that your sampling technique is correct as the results are only as good as the sample you take. The results of soil testing can be interpreted for fertilizer requirement for specific crop (Fig. 1).

NEED FOR SOIL TESTING

- To ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil.
- Lack of adequate analytical laboratory support infrastructure coupled with the lack of awareness that the mining of secondary and micronutrients in production systems
- The information on the soil fertility status is needed not only for enhancing crop productivity through balanced nutrient management, but also to promote judicious use of costly external inputs of nutrients and enhancing the efficiency of scarce water resources in developing countries like India (Sahrawat 2006; Wani 2008).
- It will also allow to determine lime requirements and can be used to diagnose problem areas.

IMPACT OF FERTILIZER APPLICATION ON SOIL WITHOUT CONSIDERING SOIL NUTRIENT CONTENT

- Excessive use of fertilizers especially nitrogenous and phosphatic fertilizers leads to environmental pollution such as eutrophication and nitrate toxicity of ground water.
- Though chemical fertilizer is an indispensable factor in modern agriculture, an excessive use of the same not only affects soil and plant health and quality but also economical holdings of farmers as the cost of chemical fertilizers are escalating day by day.
- Due to excessive use of fertilizers, the vegetative growth of crops will become progressive. Hence, the insect and pest incidence as well as crop lodging will affect the crop productivity.
- Sometimes, the blanket fertilizer recommendation for some nutrients may not meet the crop requirement and it ultimately affects the crop growth and yield.

BENEFITS OF SOIL TESTING:

- Soil testing plays a very important role in diagnosing the physical, chemical and biological properties of the soils by providing the conditions of available nutrients which indicates the fertility and productivity of the soils.
- It also helps in assessing the capability and suitability of land for agriculture and allied activities and quantifies the soil constraints.

- Soil testing helps to recommend chemical fertilizers for more judicious use in combination with organic manures and bio fertilizers and hence balanced nutrition to crop.
- Soil testing provides sound information for recommendation of fertilizers and correct amount of chemical fertilizers to be integrated with organic amendments for improving the soil health and quality in order to increase the productivity per unit area.
- Soil test based fertilizer application will enhance the probability of yield and also minimizes the fertilizer cost

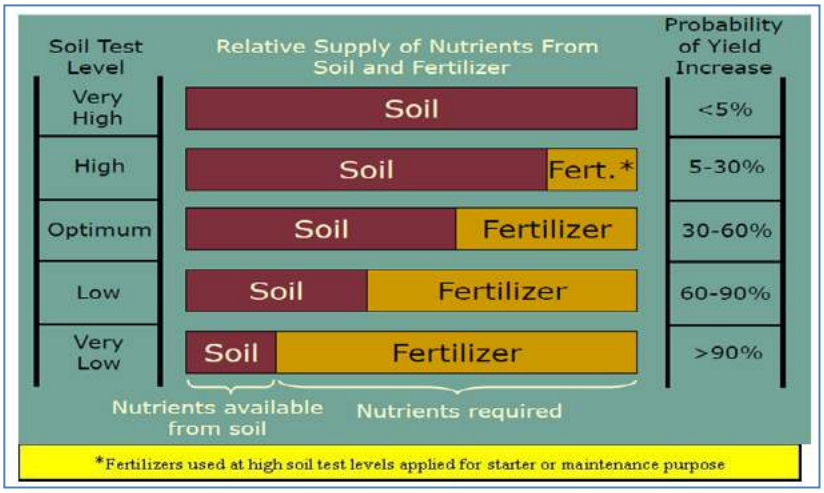

Fig. 1. Soil test interpretation categories (Havlin et al., 1999)

CONCLUSION

The quantity and availability of plant nutrient elements in the soil change as a result of removal by the growing or harvested crop, leaching, erosion, or the addition of fertilizer, manure or compost. As soil is a dynamic body and undergoes changes, it is advisable to test the soil at least once in three years and every year in case of intensive cultivation for better environmental health and crop nutrition. The soil testing will help us for better utilization of soil available nutrients, reduces the cost of fertilizers and restoring the soil quality.

REFERENCES

Naidu, L.G.K., V. Ramamoorthy, S.C. Ramesh Kumar, G.S. Sidhu and Raj Kumar. 2008. Soil based fertilizer recommendations-A rational approach. *Indian J Fertilizers*, **4**: 47-56.

Havlin, J.L., J.D. Beaton, S.L.Tisdale and W.L. Nelson. 1999. Soil Fertility and Fertilizers. 6th Edition. Prentice Hall. Upper Saddle River, NJ. 499 p.

Wani, S. P. 2008. Taking soil science to farmers' doorsteps through community watershed management. *Journal of the Indian Society of Soil Science,* **56:**367-377.

Sahrawat, K. L. 2006. Plant nutrients: sufficiency and requirements. In *Encyclopedia of Soil Science*, Second Edition, ed. R. Lal, 1306-1310. Philadelphia, PA, USA: Taylor and Francis.

Singh, A. K. 2008. Soil resource management—key to food and health security. *Journal of the Indian Society of Soil Science,* **56:**348-357.

Seed Balls: A new weapon for greening India

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Abstract

Seed balls is one of the unique and innovative technique of propagating plants from seeds without opening up of soil. They are regarded as miniature capsules, which is basically a mixture of finely filtered soil and cow dung mixed with other bio-compost, which creates the artificial climate around the seeds. Seed balls are great tool for making a neglected or unused area beautiful and green again; a quick and effective method for planting on large areas. Nowadays, seed balls are packed and gifted in birthday parties, so share and make the planet earth greener.

Seed balls is one of the unique and innovative technique of propagating plants from seeds without opening up of soil and with less effort. India's forest cover accounts only 21.35 percent of total world's area. Every year government spend crores of rupees on reforestation of public and forest lands, but the success has not been much achieved. So seed balls are the ultimate solution to the problems experienced with the traditional way of restoring natural habitat.

The traditional way of re-seeding natural areas is usually done by scattering seeds on top of the soil or digging the pits and planting the seedlings. But seed ball making is a fun and productive activity, it's a great opportunity to educate all the age groups in the society about saving the environment. Back to history of seed balls, was developed by Japanese natural farmer and a Philosopher Masanobu Fukuoka. He believed that tillage over large area is a laborious and destructive process, which also deteriorate the soil health. Thus, seed balls are becoming the important aspect of natural farming and conservation of green cover around the world. Seed balls are regarded as miniature capsules, which is basically a mixture of finely filtered soil and cow dung mixed with other bio-compost, which creates the artificial climate around the seeds. Bare seeds are either get exposed directly to sunlight, picked up by birds and other animals, blown away by strong winds or washed away by heavy rains. As the Charles Darwin's famous phrase says "Survival of fittest" suits here, among the left over seeds only few seeds might germinate but not all.

❖ **Things You Will Need**

- Well decomposed dry organic compost
- Bucket

- Seeds, select the species which of native origin and tolerant to harsh climates. Some of them are Neem, Peepal, Gulmohar, Badam, Tamarind, Jamun, Babool, etc.
- Clay free of gravels.

❖ **Preparation of Seed Balls:** The following procedures are as follows

- Add 3 Parts of well decomposed compost into the bucket.
- Blend in 5 parts of dry clay.
- Add 1 to 2 parts of water a little at a time, mixing well after each addition until thick dough like consistency is achieved.
- Some amount of chilli powder is mixed with the mixture, as it deter predators. Artesemias, mints and black pepper which may also deter predators.
- Legume inoculants can be included, which may give good germination.
- Break dough into small pieces and roll them between your hands into seed balls. It is important to keep the seed balls on the small size, around half a inch in diameter and seeds are placed in the middle of the ball. Ensure that only few seeds are place in the ball, as too many seeds per ball may result in creating too much of competition amongst the seeds for survival.
- Finally seed balls are dried in shade and are ready to throw!

Seed balls are an easy means of distributing a variety of seeds in what some refer to as "Guerrilla Gardening". These seed balls are distributed to trekkers and nature lovers to be thrown near highways, barren lands, forts, hills, lakes etc. before the commencement of monsoon. When these balls come in contact water seeds inside start to sprout, the crumbled ball provides support to its rooting system. From there, nature does its job where plants continue to produce and grow until the area is covered.

❖ ADVANTAGES OF SEED BALLS

a. Seed balls are a great tool for making a neglected or unused area beautiful and green again; a quick and effective method for planting on large areas.
b. Seed balls are perfect delivery system for reintroducing native plants.
c. Plants that are grown through seed balls would cater to not only human beings but also nurture wild animals like monkeys and birds for fruits.
d. Seed balls may help to recover degraded landscape back to productivity.
e. Seed balls have been employed to establish new pastures on steep slopes, shallow and exposed bed rocks.

In this urban areas, seed balls are packed and gifted in birthday parties, so share and make the planet earth greener.

REFERENCE

Ministry of Statistics and Programme Implementation, Government of India (ON965)

Seed Balls

Initiative of covering urban un-used urban lands through seed balls in Bangalore

Seed Balls

Seed Balls preparation at Government, college, Bokkapatna, Mangalore, Karnataka (Hindu Newspaper, 08/05/2017

Seed Balls for Greener Wari
(Pune Mirror, 11/05/2017)

Planting 3000 Seed balls in Charmudi hills, Mysore, Karnataka (Star of Mysore News Paper)

Drying of Seed Balls

Seedling emergence from Seed Ball

Sustainable Agriculture through Azolla

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The coming decades will be challenge for agriculture to meet the worlds increasing demand for food in a sustainable way. Continuous cropping, frequent cultivation of soil and intensive use of inorganic fertilizer resulted in breaking down of structure, depletion of fertility with more degradation of soil. Applying organic matter and enhancing biological nitrogen fixation combined with mineral fertilizers helps in maintaining soil fertility for sustainable agriculture. Azolla as manuring an economical, practical and even aesthetically pleasing method of restoring productivity of over worked land. Azolla plant is a free floating water fern, scientifically known as *Azolla pinnata*, it belongs to the family Azollaceae. Azolla is commonly known for its nitrogen fixing role in enhancing soil fertility and healthy food to human as well as animals.

Azolla as Symbiotic Biofertilizer

Azolla plant is associated with blue green algae (*Anabaena azollae*) which exist in the dominant cavities in the upper lobs of azolla. Symbiotic relationship between *Azolla pinnata* and *Anabaena azollae* has been found to be good than legume rhizobia symbiosis for the fixation of free nitrogen. Azolla is one of the most important biofertilizer for wet land rice. It's also considered an efficient scavenger for potassium and serves as a source of potassium for rice crop.

AZOLLA AS FOOD SUPPLIMENTS

On dry weight basis azolla contents about 15-16 % crude protein, 10-12 % crude fibre and 1-6 % calcium (Kavitha, K., 2004). The composition of azolla indicated that good nutritional value. Azolla uses as green vegetable, salad in human food, fodder and feed of goat, duck, fish etc.

Azolla as green manure

Azolla can also be used for green manuring which could contribute from 30-60 kg per hectare nitrogen. On dry weight basis azolla contents about 5 % nitrogen, 0.5 % phosphorus, 3-4 % potassium. Applied and turning of azolla @ of 1 kg/ m^2 (8-10 t/ha) 7-10 days before transplanting of rice but in case of dual crop it is applied @ 100 g/m^2 (1.5 t/ha) 2-3 days after transplanting of rice and allowed to multiply for 20-25 days. (Balasubramaniyan *et al.,* 2011).

Azolla as Compost

Azolla can be mixed with poultry wastes and others biomaterial to produce compost. It provided high value of nutrient with safe health hazard compost use for rice and mushroom production.

Multiplication of Azolla

Cememt cisterns Culture

Azolla can be multiplied in small cement cisterns, iron trays, open field nursery and dual cropping (Reddy and Reddy, 2013).

Open field nursery of Azolla

Cememt cisterns

Azolla can be multiplied in cement cisterns of 2 x 1 x 0.3 m. A layer of 7.5-10.0 cm soil is provided at the bottom of the cisterns. About 5.0-7.5 cm depth of water is maintained in the cistern. Super phosphate @ 8-12 g and carbofuran at 2.0 g are applied. About 200 mg of fresh azolla is inoculated to each cistern. In about 12-15 days, about 2.0-2.2 kg of azolla can be harvested. After each harvest, super phosphate is applied to facilitate fast multiplication.

Open field nursery

The field selected for azolla nursery should be nearer to shade, thoroughly ploughed and inoculated. The field is divided into plots of 40 m^2 area (20 x 2 m) by providing suitable bunds and irrigation channels. Water is maintained to a depth

Dual Cropping of Azolla

of 10 cm about 10 kg of fresh cattle dung is mixed with 20 litres of water and sprinkled uniformly throughout the plots. Fresh azolla is inoculated at 8 kg/plot and super phosphate (100g) is applied twice at an interval of 4 days. Carbofuran is added at 100g per plot, 7 days after inoculation to control insect pests. About 50-75 kg of fresh azolla can be harvested 15 days after inoculation. Azolla can be again inoculated with the addition of cattle dung, super phosphate and carbofuran granules.

Dual Cropping

Fresh Azolla multiplied with application of inoculums @ 500 kg/ha as basal at the time of 7-10 days after transplanting of rice field and allowed to grow 15-20 days after inoculation .

CONCLUSION

Agricultural environment is badly disrupted due to excessive chemicalisation. The challenge now a day is to maintain sustainability of food production in the long term without impairing agro-environment. Use of Azolla or it products are better substitutes of synthetic chemical product for sustainable agriculture.

REFERENCES

Balasubramaniyan, P and Palaniappan, S.P. (2011) Principles and practices

of Agronomy. *Agrobios (*India): pp 210-211.

Kavitha , K. (2004) Azolla a nature friend. *Agrobios Newsletter*. Vol. III (3): pp 30-31.

Reddy, Y.T and Reddy, G.H.S. (2013) Principles of Agronomy. *Kalyani* (India): pp 237-238.

Sericulture: Potential to Elevate Poverty

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Abstract

Silk a fiber generated from the cocoon of the various species of insects but in majority the silk produced from Bombyx mori, is considered to be the best in quality worldwide. China being ranked first in silk production followed by India where almost the demand in India for silk is about 25000 MT and we produce only 18745 MT and the rest is to be imported from China. Thus, sericulture can be very effective tool in creating employment and extra remuneration as it is a highly labour intensive industry which suits the Indian economy at its best. Sericulture as enterprise generates almost 11 man days of employment per kg of silk produced and extra income up to Rs 48000 per annum.

INTRODUCTION

The reduction of rural poverty continues to be a paramount goal of the developing countries like India as the majority of the population still resides in the countryside. The world bank, estimates that more than 70% of the world's poor live in rural areas. So far various strategies have been pursued to address this concern and the major ones in rural employment creation. The agriculture sector however has been contending with a number of factors that have limited its potential for generating new jobs in rural areas. Thus the establishment of rural based industries like sericulture, in particular, can be very effective in creating new job opportunities and providing supplemental income (Ahsan *et al.,* 1989). Being a rural agro-based labour intensive industry this sector can also play vibrant role in checking migration from rural to urban areas. Silk is an animal fiber produced by certain insects to build their cocoons. Although many insects produce silk, only the filaments produced by the mulberry silk moth, *Bombyx mori,* and few others in the same genus, is used by commercial silk industry. India being a producer of all the five commercially traded varieties of natural silks namely:

1. Mulberry Silk
2. Tropical Tasar Silk
3. Oak Tasar Silk
4. Muga Silk
5. Eri Silk

SERICULTURE AND EMPLOYMENT GENERATION

The population percentage below poverty in enrages between 47.12% to 12.72% but it is 30 % on an average in silk producing states. Silk production is the best tool to provide employment generation to poorer sections of society, as net income varies from Rs 12000 to 70000 per annum depending upon the variety of silk and area. As per the estimation of Central Silk Board, Banglore sericulture generates employment @ 11 man- days per Kg of silk produced throughout the year (Table 1).

Sericulture and higher remuneration

Sericulture as a remunerative crop can suit all categories of farmers from small/marginal farmers with meager resources to a large farmers. With short gestation periods, the returns are quick. The net returns in case of mulberry sericulture (when a farmer has one acre of mulberry plantation using family labor), is estimated at about Rs. 48,000 per annum. Mulberry is highly amenable to inter-cropping (Table 2).

CONCLUSION

Sericulture can be the major player in removing the poverty in case of India being a high labour intensive industry and low capital intensive industry. Hence sericulture should be promoted more for those states where the majority of population lies BPL to give employment throughout the year with extra source of income.

Table 1. Generation employment in sericulture (per ha)

Sr. No.	Activity	Employment generation	
		Man-days	Man-years
1	**Cultivation and Silk rearing**		
a	Cultivation	585	
b	Leaf/shoot harvesting	320	
c	Silkworm rearing	350	
	Subtotal	**1255**	**5.020**
2	**Rearing of silk cocoons**		
	@300 mandays per 1000 kgs of reeling cocoons	2250	9.120
	Total (1+2)	**3535**	**14.140**
3	**Twisting**		
	@220g of silk per mandays	432	1.727
4	**Weaning**		
	Handloom@ 0.13 kg per manday	438	1.752
	Powerloom @0.31kg per manday	122	0.486
	Sub total	**560**	**2.238**
5	**Printing and Dyeing**		
	@40 mandays for 40 kg of raw silk	95	0.380
6	**Finishing**		
	@751 mandays for 40 kg of raw silk	1784	7.135
7	**Silk waste processing**		
	@18.77 mandays per kg of raw silk	26	0.104
	Total (3+4+5+6+7)	**2897**	**11.584**
	Grand Total	**6432**	**27.962**

Source: Central Silk Board, Bangalore.

Table 2. Economics of mulberry with intercropping are

Sr.No.	Crop Combination	Additional Income
1	Mulberry+ Palak	17422
2	Mulberry + Methi	6026
3	Mulberry + Raddish	3869
4	Mulberry + Beans	4953
5	Mulberry + Greengram	9235
6	Mulberry + Blackgram	12719
7	Mulberry + Soybean	15427

Source: CSR&TI, CSB, Mysore

REFERENCES

Ahsan, M.M., Dhar, K.L., Fotadar, R.K. and Anil Dhar, 1989. Studies on intercropping of short duration crops with mulberry. *Indian Journal of Serculture*, 28 (2):194-199.

Annual Report of Central Sericultural, Research and Training Institute, Central Silk Board, Mysore, 2008. Indian Silk, Vol. 47(5).

Skill Development of Youths for Exploring Start-Up in Dairying

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ABSTRACT

India is the youngest nation of the world where nearly 70% of the population is below the age of 35 years and interestingly 70% of them live in rural areas. But unemployment ratio is also increasing day by day in India. In order to control these unemployment trend youths should be made self-employed in the different field, in this direction the government of India also has created a SKILL INDIA programme to provide skills to rural youths in different sectors. Similar way in dairy farming also youths can be trained with different skills to make them self-employed. Youths can be attracted and retained in agriculture and allied activity through developing micro-business models in farming as it offers scope for regular sustained income. Starting a business can be risky and challenging, but armed with the proper tools and information, youths can be put on the path to entrepreneurship

INTRODUCTION

Empowering today's youth is our greatest responsibility. Providing a platform to create professional and business-oriented farming systems for youths will be very important. One of the biggest challenges for Indian agriculture would be retaining its youth in agriculture. Unless farming becomes both intellectually stimulating and economically rewarding, it will be difficult to attract or retain youths in farming (Swaminathan, 2006). The youth will be attracted to agriculture once smallholders tangibly improve their livelihoods. Universities, governments and state departments, NGOs must give more recognition to farmers and support them by giving better access to market information, developing tailored mobile applications and training youths in their use (Ayyappan, 2014)

CONCEPT OF YOUTH

The Ministry of Human Resource Development considers 'youth group' in India as persons in the age group 15 to 35 years. The Youths are those who are trying to bridge the gap between dependent childhood and independent adulthood. The United Nations declared 2011 as the 'International Year of Youth' in which the issue of "making farming attractive to youths" was deliberated vigorously.

SKILLS IN DAIRYING

The only possibility of retaining youths in agriculture and allied activity is through

developing micro-business models in farming as it offers scope for regular sustained income. Since agriculture is mostly seasonal, there is a little possibility of finding employment throughout the year. Thus, dairy farming which provides employment throughout the year is a best choice for youths to start-up ventures.

Broadly in Dairy farming mainly there is two types of skills are prevalent

1) Farming skills
2) Technical skills

Forming skills:

Forming skills includes rearing of milch animals; dairy farming is an important source of subsidiary income to small/marginal farmers and agricultural labourers. India continues to be the largest producer of milk in world. Several measures have been initiated by the Government to increase the productivity of dairy animal, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the Tenth Plan (2006-07) to 127.9 million tonnes at the end of the Eleventh Plan (2011-12). Milk production during 2014-15 and 2015-16 is 146.3 million tonnes and 155.5 million tonnes respectively showing an annual growth of 6.27%. (MoA&FW, GoI, 2016-2017). Thus, there is a tremendous scope/potential for increasing the milk production through profitable dairy farming.

In addition to milk, the manure from animals provides a good source of organic matter for improving soil fertility and crop yields. The gobar gas from the dung is used as fuel for domestic purposes as also for running engines for drawing water from well. The surplus fodder and agricultural by-products are gainfully utilised for feeding the animals.

Technical skills:

Dairying consists many technical skills through which youths can be self employed some of those are as follows

1) Value addition in milk

Youths have the opportunity to add value to raw milk by producing a wide variety of processed products, to increase the return above the base price of raw milk. These include:

- Heat-treated liquid drinking milk, such as pasteurising, or ultra high treatment, then adding flavours or incorporating it into other drinks
- Separating the milk fat from other milk solids to produce butter and ghee, and also skim milk
- Fermenting milk to produce yoghurt, which is also called curds in some countries
- Fermenting milk to produce cheese with its major by-product, whey
- Using the by-products, skim milk and whey, to produce ice cream, cheese and whey based drinks
- Adding ingredients to heated milk to produce a variety of sweets such as caramel. Further processing, such as adding acids to coagulate the milk, produces different kinds of sweets
- Using cheese in cooking to produce high-value products such as cheesecakes.

2) Para vet

Rural youths can train as para vets who are having Basic education (10^{th} and 12^{th}). They can train on the topic animal husbandry basics related issues. Veterinary doctors are very few in India,

so youths can be trained on these aspects by that they can perform first aid service and Artificial insemination to the animals at field condition.

3) Shoeing of animals:

Recent day's peoples who do shoeing of animals are very few, so youths can trained to fix the shoeing in scientific manner. Shoeing of animals requires well trained, skilled personnel for handling, fixing, and training of the animals.

4) Feeding manufacturer:

Manufacturing concentrate feed for the animals is also a profitable venture. Most of farmers use home-made concentrates, plus by-products and commercial concentrates. Home-made concentrates comprised of local feed resources, it decrease feed cost of production, by adding value to the own production. Milk producers are advised to adjust the quantity of locally available feed ingredients offered to their animals along with their mineral mixture.

5) Organic milk and milk Products

Organic milk and milk products refer to milk produces from dairy animal raised according to organic farming methods. In most jurisdictions, use of the term "organic" or equivalents like "bio" or "eco", on any product is regulated by food authorities. In general these regulations stipulate that livestock must be: allowed to graze, be fed an organically certified fodder or compound feed, not be treated with most drugs (including growth hormone), and in general must be treated humanely. Organic dairy farming is a system of production, a set of goal-based regulations that allow farmers to manage their own particular situations individually, while maintaining Organic dairy organic integrity.

6) A2 milk

A2 milk is cow's milk that contains only the A2 type of beta-casein protein rather than the more common A1 protein commonly found in regular milk. A2 milk is licensed and marketed by the a2 Milk Company and sold mostly in Australia, New Zealand, China, United States and the United Kingdom. Recent days A-2 milk is gaining importance in India also, so youths can take this opportunity to start-up business in producing A-2milk.

Why there is need to develop skill of youths in Dairying

a) To increase the entrepreneurial ability of the youths in dairying
b) To make them self employed and also they can give employment to others
c) To reduce the Unemployment among youths in the country
d) To meet the need of Increasing Population of India
e) To meet the high Demand of milk and milk products

Constraints in skill development in agricultural and allied sector

- ✓ It is capital intensive
- ✓ It is labor or management intensive
- ✓ Outbreak of diseases
- ✓ You need intensive and extensive knowledge of the business
- ✓ The problem of quality of the milk produced
- ✓ The maturity period for the cows to start producing milk takes time thus leading to tight profit margin
- ✓ Maintaining high production efficiency

- ✓ Difficulty in increasing scale of operation

Ways to develop Skill among Youth in Dairying

- ➢ The first step is to change the image and perceptions about dairying in the face of the youths. Dairying Portrayed as a low-income, high-risk career and drudgery involving work so public perception of the dairying must be improved to entice more youths to explore business in dairying.
- ➢ The positive aspects of choosing dairying should be emphasised to the youth i.e. owning your own business, choosing your own hours and having a variety of daily responsibilities.
- ➢ The policies at the national level also rarely feature the concern or issues of the young on the future of food, farming and development. The line Ministry of agriculture can, for example, set up a Youth Advisory Committee to look into various ways of attracting, developing skill and retaining the youth in this sector.
- ➢ Access to affordable credit is another key factor; the young people tend to have fewer chances of obtaining capital or skill loan. Access is often tied to the availability of collateral, which is usually land that the young people do not have. It is, therefore important that appropriate affordable financial packages are put in place by financial institutions involved in agricultural lending.
- ➢ Agribusiness support agencies should also play a key role in attracting the youth in agriculture. They can do this by highlighting in their mandates for interventions, a criterion for youth involvement for programmes they intend to support. The agricultural subsectors that have potential to increase employment of mainly the youth should be strategically supported.
- ➢ When dairying becomes a truly viable venture, we are more than certain that the youth of India will be enthusiastic in taking it up. In a country where university graduates are prepared to work as night guards, street vendors etc, profitable dairy farming can be attractive.

CONCLUSION

It is a high time now measures should be taken to improve the physical and mental development of the youths of the country so that none of them remains unemployed. It is time to open up avenues by which the youth accepts responsibility and no one remains idle because an idle youth is a burden to the economy. In this context dairy farming is great choice, which provides employment throughout the year. Dairy farming consist different skills to perform in which youths can be trained and can make them self-employed. The challenge that we must take up, as leaders, facilitators, policy makers and private sector in India's agricultural development is to build the capacities of the youth and equip them to address the emerging requirements of an attractive dairying that offers prospects for viable incomes and good quality of life

REFERENCES

Ayyappan, S. 2014. "Youth for Transforming Indian Agriculture". Keynote address delivered during

Dr. D. Sundaresan Memorial Oration, at NDRI Karnal.

MoA&FW, 2016-2017. Annual Report of ministry of Agriculture and Farmers Welfare. Government of India. New Delhi

Swaminathan, M. S. 2006. Summing up address. Delivered on the occasion of "Consultation on attracting and retaining youth in farming",May 29th , New Delhi.

Composting of Plant Residues for Soil Fertility Improvement

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Crop residues are the non-economic plant parts that are left in the field after harvest. The harvest residues include straws, stubble, stover and haulms of different crops. Also includes process wastes like groundnut shell, oil cakes, rice husks and cobs of maize, sorghum and cumbu. In Tamil Nadu, 190 lakh tones of crop residues are available for use. These residues will contribute 1.0 lakh ton of nitrogen, 0.5 lakh ton of phosphorus and 2.0 lakh tons of potassium. However crop residues need composting before being used as manure. Nutrients are continuously depleted from the soil by crops at different stage of growth. To take up the sowing of next crops, plant residues are immediately burned in the field or left unused in outside of the field. Continuous burning of residues causes environmental pollution, volatile losses of nutrients & eradicating the beneficial organisms in the soil. To improve the soil fertility as well to reduce the environmental pollution, residues must be composted and utilized as manure for crop production.

Composting

Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. The following steps are involved in the composting.

1. **Waste collection**

Crop residues collection is the primary step in composting. Crop residues collected from the different places should bring to the single point allotted for composting. It should be located in anyone corner of the farm. Water resource should be near to the composting yard to facilitate the maintenance of optimum moisture content in heap.

2. **Shredding of waste materials**

Size of the crop residues is one of the factors that influence the composting. Manual Shredding is time consuming & expensive. To speed up the shredding process, Shredder machine can be used to shred all the crop residue biomass. Particle size of 2 to 2.5 cm is preferable for quick composting.

3. **Mixing of green waste and brown waste**

Carbon and nitrogen ratio of the composting heap is a deciding factor of compost. If C:N ratio is wide (100:1) composting will not completed. The ideal C:N ratio for composting is 30:1. To get a narrow C:N ratio, carbon and nitrogen rich material should be mixed together. Green coloured waste materials like glyricidia leaves, parthenium, freshly harvested weeds; sesbania leaves are rich in nitrogen, whereas brown coloured waste material like straw, coir dust, dried leaves and dried grasses are rich in carbon. These carbon and nitrogen rich materials should be mixed uniformly to make the composting faster. Animal dung is also a good source of nitrogen. While making heap formation, alternative layers of carbon rich material, animal dung and nitrogen rich material are to be heaped to get a quicker result in composting.

4. Compost heap formation

Size of the composting heap is a criterion determines the composting process. Alternate layers of carbon and nitrogen rich material with intermittent layers of animal dung are essential for composting. For each step to ensure the moisture content in the heap, watering is must.

5. Bioinputs for composting

To hasten the composting within a minimum time, addition of accelator instead of cowdung is important. To get good composted manure from the plant residues with minimum time, Tamil Nadu Agricultural University (TNAU) Biomineralizer can be applied in the heap. This consortium contains groups of microorganisms, which accelerate the composting process. If this inoculum is not used for composting, natural microorganisms will established & starts the composting workbut the process takes time to give manure.

For one ton of crop residues, 2 kg of TNAU Biomineralizer should be applied. This two kg Biomineralizer should be mixed with 20 liters of water & sprinkle over the heap. Though the cow dung slurry can also be a good source for microbial inoculum, it carries unwanted microorganisms also which may compete with composting organism. But when TNAU Biomineralizer is not available, cow dung slurry should be applied. For one ton of crop residues, 40 kg fresh cow dung is sufficient. This 40 kg fresh cow dung should mixed with 100 litres of water and it should be thoroughly poured over the waste material. Cow dung slurry acts as nitrogen source as well as source of microbial inoculum.

6. Aerating the compost material

Aeration of the heap ensures the composting process. To improve the composting process, frequent turning is important. Once in 15 days or monthly turning enhanced the composting process quicker than undisturbed heap.

7. Moisture maintenance

To sustain the longevity of composting microorganisms, throughout the composting period 60% moisture should be maintained. If optimum moisture condition is not maintained, , microorganisms available in the composting heap will die and the composting process will get delayed.

8. Maturity of compost

After the stipulated time, to observe the maturity of the compost, size of the compost, colour of the compost andodour, are being considered as deciding factors. After satisfying with the compost maturity index, the compost heap should

be disturbed and spread over the floor for curing. After curing for one day, the composted manure should be sieved through 4 mm sieve to get uniform composted material. The residues retained on the sieve should be again composted to finish the composting process.

9. Enrichment of compost

To improve the nutrient content of the compost, it should be enriched with Azospirillum, Pseudomonas, Phosphobacteria (2 kg/ tone of compost) and rock phosphate (20 kg/tone of compost). Forty per cent moisture should be maintained for the growth of microorganism. This incubation should be allowed for 30 days for the organism to reach the maximum population.

Advantages of compost

- The enriched manure contains both nutrients and beneficial microorganisms. While applying the manure, there is an improvement in the physical, chemical and biological properties of the soil due to regular addition of compost.
- Quality products will be obtained from the crop due to improvement in the soil fertility status. Soil organic matter content increased and soil biodiversity also improved due to enhanced soil organic matter content.
- Organic manures are highly regarded as good source of material to maintain soil health and increasing soil organic carbon content.
- Organic manures cannot be equated with inorganic fertilizers. But organic manures deliver all the nutrients to the soil but with little quantity.
- For one hectare of land 5 tons of enriched compost is recommended. It can be used as basal application in the field before taking up planting work.

Immuno-pathology and therapeutics of retained fetal membrane in Bovines

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Retained placenta is one of the most common complications occurring in animals following parturition. The affected animals, not only, produce less milk but also losses in its future reproductive efficiency. Expulsion of the placenta within the stipulated period is important for subsequent reproductive efficiency as it helps in initiating involution of the uterus and appearance of post partum heat. Delay in involution of the uterus on the other hand, increase the calving interval and reduces the total number of calving during the reproductive life of the female. In normal physiological parturition the fetal memberane are expelled with in 3-8 hr in cows and buffalo.

ETIOLOGY

In majority of cases, placental retention in cattle is caused either by disturbance of the loosening mechanism in the placentomes or of uterine inertia. The physiological process that leads to separation and expulsion of placenta starts many days or weeks or even month before parturition, so that by the time RFM is diagnosed, the effect and not the cause is treated and the chances to response to therapy are few. Various pathological factors that affect the loosening process in the placentomes includes:

I. **Immature placentomes:** These are associated with shortened gestation period (abortions, premature parturition). These are believed to result from insufficient hormonally induced changes in the maternal connective tissue and crypts epithelium.

II. **Edema of the chronic villi:** It is usually associates with uterine torsion or caesarean section.

III. **Advanced involution of the placentomes:** Advanced involution of the placentomes occurring in cases of prolonged gesta!ion is accompanied by proliferative changes in the maternal caruncles that mechanically inhibit loosening.

IV. **Hyperemia of the placentomes:** It is seldom considered- to be the cause of RFM. This could occur before parturition or perhaps could even be caused by too rapid closure of umbilical vessel.

V. **Placentitis and cotyledonitis:** Various organisms responsible for this are *Brucella abortus, tuberculosis, Vibrio fetus.*

IBR, IPV virus and various mold infections due to aspergilli or mucor molds. Severe enzootic outbreaks of retained placenta or secondary metritis are due to highly virulent organism of *Stapphylococcus dysgalatiae.E-. coli, Staph*lococucus, *Pseduomonas and Corynebacterium pyogenes* developing in the brans or calving stalks.

VI. **Uterine atony:** This is often associated with dystocia, hypocalcemia, hydropic and other pathological conditions, contributing to the failure of palcenta to be expelled.

VII. **Nutritional factors:** Many nutritional factors like deficiency of vitamin A, carotene, selenium and iodine in diet causes increased incidence of RFM.

VIII. **Mechanical prevention of placental exclusion:** This occurs in very isolated instances, at the most contributing0.5 per cent of all cases of RFM. The fully or nearly detached cotyledons become trapped in a rapidly closing passage of the non-pregnant of invaginated uterine horn or in a double cervical canal or behind a flashy band in the vagina. Such complications are usually caused by very large cotyledons.

IX. **Miscellaneous causes:** It is found that short dry period in dairy cattle (less than 5 weeks), transport stress, changes of locality in advanced pregnancy, high "milk production, pro-longed gestation etc. also caused increased incidence of RFM. Treatment and prevention of retained placenta in dairy cattle The basic goal of any therapeutic method is a removal of the retained mass and return of the cow to reproductive usefulness as soon as possible and the prevention of secondary complications that can lead to economic losses from lowered milk production and delayed conception.

There are various methods for the treatment of RFM.

1. **No treatment**: There is no significant difference between the fertility of cows with a retained placenta and left untreated compared with cows without RFM. A disadvantage of no treatment is that in a number of cows a malodorous stench is generated by the animal which generally can be prevented by the treatment-especially, broad. Spectrum antibiotics are quite capable of keeping down the microorganisms which are primarily responsible for putrifaction.

2. Manual removal: Manual removal of retained placenta in the cow has been practised by most veterinarians.

Advantages of manual removal of placenta include:

1. Involution may be shortened.
2. There may be less chances of secondary infections.
3. Specially during summer the owner may not like to have the odour of the placenta in barn. As long as the placenta is left, the cow has to be kept in the barn which is inconvenient in the summer.

Disadvantages:

1. Even the most careful veterinarian will cause some-trauma which may introduce Pathogenic organisms into the uterine wall.
2. Secondary infection may be carried in by the operator. This is important to remember.
3. It was reported that the phagocytosis viz. uterine leucocytes were completely inhibited for several day following attempts at manual removal.

4. The time of removal is also controversial.

PROCEDURE TO BE FOLLOWED FOR MANUAL REMOVAL

Scrub and disinfect the vulva and surrounding area. Be as clean as possible in entering the uterus. Epidural anesthesia is also indicated to stop straining and also helps in preventing repeated defecation on your gloves. Use sterile plastic or rubber sleeves. Plastic gloves are easy to use and are disposable but may break, rubber gloves are excellent to use but must be washed and sterilized after each use. The hand is inserted (after proper lubrication with sterile lubricant) between the Endometrium and chorion in the inter cotyledonary space of the individual fetal cotyledon and its caruncles are grasped gently, each placentome is grasped, squeezed and with the thumb and forefinger the two structures are gently separated by a rolling, pushing and squeezing motion. This may be added by traction with the other hand on the adjacent portions of the FM as the separation is completed. The cotyledons in the cervical areas of the uterus are removed from the caruncles first and then by traction with the outside hand the placenta is pulled out and tension is maintained as the cotyleaons in the middle portion of the horn and the non gravid horn are removed.

Do not use any force to separate the membranes from the caruncles. Leave the placenta if the cotyledons are strongly adhered, spend no more than (I5 minutes in removing the placenta, otherwise leave it). The layman's practices of tying a weight on the placenta or of cutting the placenta off close to the vulva are not desirable. First, the weight causes the cow to strain and causes premature and incomplete breaking away of the after birth leaving a part of it still in the uterus. In rare cases this wt. may cause invagination of the uterus horn. Removing the placenta closed to their vulva in order to prevent the cow from swinging it against the milker is likely to result the placenta dropping back into the uterus, followed by early closure of the cervix. The afterbirth may remain in the ut. long after it has separated from the caruncles, because the wt. of the placenta handing from the vulva is not present to draw it out. I-f the placenta is d-ragging on the ground it should be cut off at the level of the hocks to prevent its being stepped on the tom away from the ut. When the RP is not manually removed several alternate forms of therapy have been observed. Drugs that increase uterine motility including oxytocin (10 IU), estrogen (15-20 mg), ergot derivatives (3 mg, contraindicated in buffaloes), calcium preparations, PGF2 alfa (25 mg) and its analogue have shown limited benefit. The lack of effectiveness is not surprising, considering the low incidence of RFM due to uterine atony without a disturbance in the loosening process in the placentome. In recent years use of broad Spectrum antibiotics have been applied to ut. either as infusion as in capsular form.

Essential prerequisites for intrauterine therapy are:

1. Rapid dissolution and distribution of the drug throughout uterus.
2. Maintenance of antimicrobial activities.
3. Good penetration into endometrial layers.

4. Limited systemic absorption and lack of irritation.

Despite the almost universal application of antibiotics, their effectiveness or intrauterine treatment is questionable in many cases. It may be safe to conclude that:

1. BSA are able to control putrefaction.
2. Despite repeated i/ut treatment with antibiotics freedom from infection is not always achieved.
3. The fertility of cows calved normally but getting RFM and treated intrauterine with antibiotics is unlikely to be similar to those when calved normally without RFM.

Disadvantages of repeated intrauterine therapy.

1. Development of resistant strains.
2. Necessity of antibiograms
3. Milk and tissue residues.
4. Sometimes even a prohibitive cost.

Hormonal treatment

There are mostly used to increase the contractions of the uterus which help in the loosening mechanism of placenta. Oxytocin may reduce the incidence of RFM if used within 24 hrs after a birth of calf. Arthur (1982) reported that 10IU oxytocin to cows immediately after calving reduced the rate of retention from 10 to 1 per cent. Combination of oxytocin with PGF2alfa can increase both the tone and frequently of contraction of bovine myometrium thus helping in the expulsion of FM. The estrogens have been widely used in the treatment of RFM. It increases ut. tone, relaxes cervix, increase blood supply to the uterus and make it more resistance to infections. Non-antibiotic antibacterials have been advocated for the i/ut treatment of RFM because of absence of proven benefit of antibiotics. Infusion of Lugol's solution for 2-3 days until placenta drops is an effective antimicrobial.

Prevention and prophylaxis of FM

1. Good nutrition, avoid overfeeding Selenium,. Vit. A.
2. Large animal boxes.
2. Good hygiene, environmental contamination kept minimum.
3. Breeding policies reduce dystocia.
4. Extended dry period.
5. Avoid stress - transport, psychological.

Mastitis Control through Dry Cow Therapy

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Abstract

Mastitis is a disease of great economic consideration in buffaloes, which is characterized by the inflammation of the parenchyma of the mammary glands. Mastitis is a multifactorial disease and bacterial pathogens play an important role in the occurrence of the disease. The maximum chances for getting the new bacterial infections are during the dry period. During early dry period and at the end of the dry period mammary glands are highly susceptible for getting the new intramammary infections. Dry cow therapy is an effective technique to remove the prevailing intramammary infections and to inhibit the occurrence of new cases of mastitis, post-partum. The choice of dry cow antibiotic therapy should be done in such a way that it is effective against the prevailing environmental and coliform pathogens. The use of teat seals as a prophylactic measure of treatment is gaining popularity because through the use of internal teat seals great success has been achieved and there is no concern of antibiotic resistance, which is a burning issue now-a-days. Dry cow therapy is better than lactation therapy for treatment of mastitis because dry cow therapy has higher cure rates, reduction in antibiotic residue in milk and it is a cost effective therapy as compare to lactation therapy.

INTRODUCTION

Mastitis is one of the greatest problems of bovines faced by milk industries because it causes huge economic losses due to losses in milk production by discarding of milk from affected quarters and veterinarian's cost. Mastitis is characterised by inflammation of the parenchyma of the mammary glands, various physical and chemical changes in the milk and pathological changes in the glandular tissue. Approximately 140 microbial species, subspecies and serovars have been isolated from bovine mammary gland. Among microbial species various types of bacteria, viruses, fungi and algae have been identified as mastitis causing pathogens. However most of the mastitis causative agents in India are *Staphylococci* spp., *Streptococci* spp. and *E. coli*.

New bacterial infections during dry period

Non lactating 'dry' period is the specific period between two active lactating phases and the changes in mammary gland occurs dynamically both in structure and function. Dry period is responsible for adequate proliferation and differentiation of the mammary secretory epithelium for the optimum

synthetic and secretory function in the ensuing lactation of the cows. There are three stages of the dry period: 1) period of active involution; it begins with cessation of milking, 2) period of steady state involution; it represents the time when the mammary glands are fully involuted, 3) period of colostrums formation and the initiation of lactation.

Mammary glands are highly susceptible for new intramammary infections during the early dry period. Because after cessation of milking several changes may affect susceptibility of mammary glands to new intramammary infections: a) termination of flushing effect of milking leads to bacterial colonization in teat canal, b) the increased intramammary pressure cause leakage of milk and the penetration of the bacteria to teat canal occurs, c) during early involution the defence mechanism of the mammary gland are at low level. During the second stage the mammary glands are resistant to the new infections mainly due to the physical barrier of the keratin plug which effectively seals the streak canal. Again, the susceptibility for the new infections increases in the third stage as the keratin plug breaks down and the leukocyte function is impaired. Therefore, by preventing the new intramammary during dry period greatly helps in reduction of new cases of mastitis after the parturition.

DRY COW THERAPY AND ITS AIM

Dry cow therapy is the use of antimicrobial therapy at the end of lactation. It is one of the key steps in mastitis control programs and has become the most effective and widely used control method for dry cows. Dry cow therapy aims at removing the prevailing intramammary infection and inhibiting the new infections.

Preparations for the dry cow therapy

The standard method for cessation of lactation (drying off) for industry is abrupt cessation of milking, by which milking is stopped on the day scheduled for dry-off (all cows are usually scheduled on the same day each week for drying off) and this helps in facilitation for administration of dry cow intramammary antibiotics. Abrupt cessation of milking leads to higher new intramammary infection rate in the dry period compared to intermittent cessation, although the increase in prevalence is most evident in cases that are not treated during dry period. The best approach to dry off cows therefore, is intermittent milking.

As the cow is susceptible for the new intramammary infections in initial weeks of dry period by environmental pathogens and in last weeks by environmental and coliforms pathogens. Therefore, the dry cow therapy should be extended over the whole dry period. Therefore, dry cow antibiotic therapy requires good activity against *Staph. aureus* including β-lactamase producing strains, *Staph. uberis*, *Strep. dysgalactiae, Strep. agalactiae,* and if prophylaxis against the summer mastitis is required , therapy should also be effective against *Arcanobacterium pyogenes*. Therefore, the widely used intramammary injections contain narrow spectrum penicillins (penicillin, cloxacillin, oxacillin and nafcillin), cephalosporins and spiramycins. Regulation in the duration of the effect of the antibiotic can be done by pharmaceutical manipulation of the intramammary drugs, *e.g.* precipitating the antibiotic, dissolving it in a slowly

absorbing oil or micro-encapsulation. The use of effective dry cow products results in 70-98 per cent elimination of existing infections. However, elimination of *Staph. aureus* is less successful. It is important that the instructions mentioned on the label should be followed carefully for the recommended dosage level, required withdrawal period, storage guidelines and expiry dates.

The idea of use of teat seals as a prophylactic measure of treatment has gained the popularity over the use of antibiotics in farm animals. The external teat seal is a latex barrier teat dip that forms a physical seal between the teat and environment, thus reduces the incidences of new intramammary infections. An internal teat seal containing bismuth subnitrate was developed in 1970s. Internal teat seals achieve the much greater success as compared to external teat seals in reducing the new intramammary infection up to 90 per cent during the dry period. Quarters with external teat seals have been found to be positive for the lower level of infection as compared to unsealed quarters but the external teat seals are not effective as compared to internal teat seals. Internal teat seals remain lodged in the lower teat for at least three to four weeks following drying-off. Incorporation of antibiotics or other suitable antimicrobials into teat seal can prevent inadvertent contamination during infusion of teat seal in teat canal, therefore now a day the teat seal with antimicrobial are also used for improving the safety of the product.

Dry cow treatment procedures' should be carried out as follows-

- Completely milk out the udder.
- Immediately following teat cup removal, dip all teats in an effective teat dip. Generally used teat disinfectants are; 0.55 per cent chlorhexidine, initial application of 2 per cent sodium hypochlorite and gradually increase its concentration up to 4 per cent, and 0.1 per cent iodophore. The gold standard teat dip is an iodine-based teat dip in 10 per cent glycerine.
- Dry the teat dip. If necessary, remove excess dip from teat ends by a clean single service paper towel.
- By scrubbing, disinfect each teat end for a few seconds with a separate alcohol-soaked cotton swab. Start with the teats on the farther side of the udder from you and after that work to the nearer side.
- With a single-dose syringe of a recommended dry cow treatment, infuse each quarter. First infuse in the teats on the near side of the udder. For infusion, use the partial insertion method of administration into the teat streak canal. Preferably, a modified infusion cannula should be used for the infusion of the intramammary preparations.
- Dip all teats in an effective teat dip immediately following the treatment.

ADVERSE EFFECTS OF DRY COW THERAPY -

- The random antibiotic therapy kills the normal bacterial flora of the teat canal and the teat end, thus allowing pathogenic and antibiotic-resistant bacterial colonization in the area.
- Antibacterial use over a large-scale increases the selection pressure to spreading of antibiotic-resistant bacterial strain.

- Irritation of teat ends.

BENEFITS OF DRY COW THERAPY

- Higher cure rates are found as compared to the lactation therapy.
- Higher dose of antimicrobials can be used safely.
- Longer retention time of antimicrobial occurs in udder as compared to the treatment during the lactation therapy.
- Reduction in incidence of clinical cases of mastitis.
- Reduction in contamination of milk with antimicrobial residue.
- Minimum cost of treatment of mastitis in one quarter in a buffalo may be approximately Rs. 2300 including cost of medicines, veterinarian consultancy and loss of milk as compare to approximately Rs. 800 for the dry cow therapy.

CONCLUSION

During dry period mammary glands are at a great risk of getting new intramammary infections. Dry cow therapy by use of intramammary antibiotics is very effective for removing the prevailing intramammary infection and inhibiting the new infections for control of mastitis. Teat seals now-a-days are gaining popularity as a prophylactic measure of treatment as they have no problem of antibiotic resistance and antibiotic residues in milk. However, few adverse effects are associated with dry cow therapy, but higher cure rates are found through dry cow therapy and it is a cost effective way for the control and treatment of mastitis as compared to the lactation therapy.

REFERENCES

Ahmad, T., Nadeem, A., Saleem, M.I., Nadeem, M. and Saqib, M. (2015). Control of Mastitis Through Dry Cow Therapy: A Review. *Scholar's Advances in Animal and Veterinary Research*, *2*, pp.128-135.

Crispie, F., Flynn, J., Ross, R.P., Hill, C. and Meaney, W.J. (2004). Dry cow therapy with a non-antibiotic intramammary teat seal-a review. *Irish Veterinary Journal*, *57*(7), p.412.

Janosi, S.Z. and Huszenicza, G. (2001). The use of the dry cow therapy in the control of bovine mastitis. *Veterinarni Medicina-Praha*, *46*(2), pp.55-60.

Radostits, O.M., Gay, C., Hinchcliff, K.W. and Constable, P.D. (2007). A textbook of the diseases of cattle, sheep, goats, pigs and horses. *Veterinary Medicine 10th edition Bailliere, Tindall, London, UK*, pp.737-741.

Bacterial Zoonotic Diseases of Poultry: A Serious Public Health Hazard

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Poultry keeping is one of the most popular livestock enterprises in India, due to its low capital investment and space requirements. The poultry industry comprises of both smallholder and large scale poultry producers under commercial hybrid or indigenous poultry production system. The birds are reared under intensive production. Indigenous poultry production system is the dominant production system in India, which is concentrated in rural and peri - urban areas such as India and other major towns in the country. Zoonoses are infectious diseases of animals (usually vertebrates) that can be naturally transmitted to humans. Zoonoses can be caused by a range of pathogens such as viruses, bacteria, fungi and parasites; of 1,415 pathogens known to infect humans, 61% are zoonotic. Most birds are asymptomatic carriers of the zoonotic diseases though in young birds, diseases like Newcastle disease and avian influenza manifests with high morbidity and mortalities which approaches 100%. Human transmission occurs through exposure to contaminated avian faecal material, oral and nasal discharges or consuming improper cooked avian meat or eggs. Humans also get infected with wild avian zoonotic diseases like West Nile Virus, avian influenza due to the interaction between carrier host and domestic birds which get infected and act as a source of zoonoses. Other major factor contributing to the transmission of new zoonotic pathogens in human population is the increased contact between humans and wildlife. Bird-keepers (pet bird owners and poultry producers) should be aware that some avian diseases can be transmitted to humans. For most people avian diseases do not pose a serious threat, but bird-keepers should be aware of them and seek medical assistance if necessary.

Table No. 1: List of Zoonotic disease agents associated with poultry

Viruses	Bacteria (primarily food-borne)	Bacteria (other)	Fungi
Avian influenza Newcastle disease	Campylobacter Salmonella Escherichia coli (colibacillosis) Clostridium perfringens Listeria monocytogenes Staphylococci	Chlamydia psittaci (ornithosis, psittacosis) Erysipelothrix rhusiopathiae Mycobacterium avium (avian TB) Pasteurella multocida (respiratory pasteurellosis)	Aspergillus species* Microsporum gallinae (favus, ringworm) aspergillosis is primarily an environmental infection, but is at least potentially zoonotic and is associated with poultry

Individual susceptibility and the seriousness of these various microbial infections varies with age, health status, immune status (immunodeficient or immunosuppressed), and whether early therapeutic intervention is sought. The ability of a microorganism to make a person sick varies with the virulence of the organism, the dose to which the person is exposed, as well as route of infection. Chlamydiosis, salmonellosis, arizonosis, and colibacillosis are the most common of these infections. Chlamydiosis, salmonellosis, eastern equine encephalitis and avian tuberculosis may be serious and even life-threatening.

CHLAMYDIOSIS

Chlamydophila psittaci is a bacterial organism that occurs worldwide and affects more than 100 avian species. The disease is also referred to as parrot fever when it occurs in psittacine birds (psittacine refers to parrot-like birds). It is referred to as ornithosis in other birds. Chlamydiosis is primarily transmitted by the inhalation of contaminated fecal dust and is spread by carrier birds that act as the main reservoir for the disease. The organism is secreted in both the feces and nasal secretions. The carrier state can persist for years. *C. psittaci* can survive drying, which allows it to be transmitted on contaminated clothing and equipment. It can also be transmitted from bird to bird, from feces to bird, and from bird to human. Human-to-human transmission can occur as well, mainly by exposure to infected saliva. Infection in humans is extremely rare and is often misdiagnosed. Treatment for *C. psittaci* usually consists of tetracycline or microlides in both humans and birds, although the treatment span may be different. Tetracycline is not

recommended for children or pregnant women.

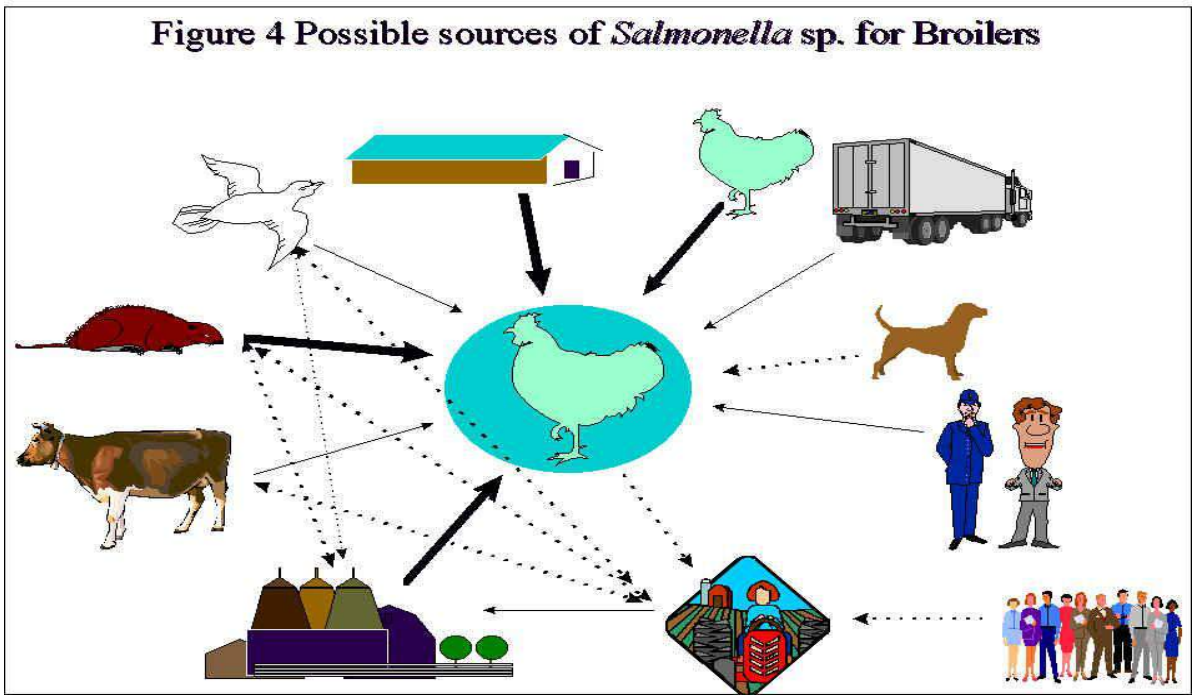
SALMONELLOSIS

Avian salmonellosis is an important cause of clinical disease in avian and a source of food borne disease in human. The etiological agent of fowl typhoid and pullorum disease is *Salmonella enterica* subspecies enteric, serova Gallinarum. Transmission mostly is through faecal - oral route. Chick maybe infected early by vertical transmission either from infected ovary, oviduct or from infected egg during the passage through the cloacae of infected or carrier birds. Humans get infected by eating raw chicken or egg products which are already infected by salmonella or food and water contaminated with faecal material of infected birds. .Fowl typhoid occur as peracute, acute or chronic form of disease affecting mostly adult avian whereas pullorum disease affects the very young chicken mostly two-three weeks of age and in adult, the disease tends to be chronic. Clinical signs in chicken include anorexia, drop in egg production, increased mortality, reduced fertility and egg hatchability. In humans, salmonella infection causes diarrhoea and destroys epithelium leading to gastro-intestinal ulceration.

LISTERIOSIS

Listeriosis is a disease that causes septicaemia or encephalitis in humans, animals and birds. The causative agent is *Listeria monocytogenes*. *Listeria monocytogenes* is a medium sized gram positive rod, non- spore forming and non-acid fast bacteria. Most indigenous chicken are carriers of *Listeria monocytogenes*. Humans are infected by the bacteria through contact with affected birds, and consumption of their product and unpasteurized milk. Most cases and deaths occur in pregnant women, newborns, the elderly and immunosuppressed adults. In avian, all

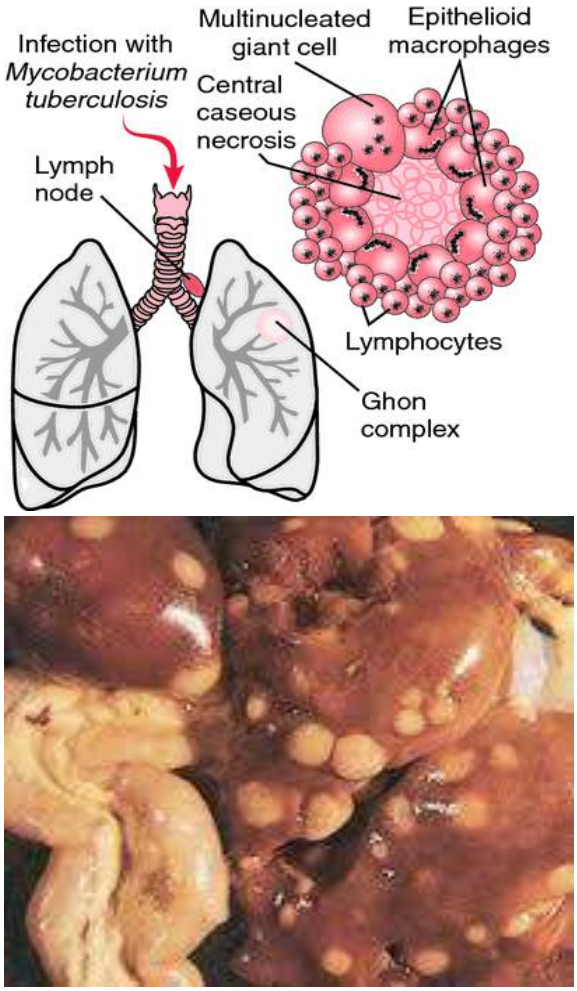
Figure 4 Possible sources of *Salmonella* sp. for Broilers



age group are susceptible but the disease is primarily of the young birds where it causes a septicaemia with focal necrosis in the liver, myocardium, pericarditis and occasionally encephalitis manifested as torticollis in broiler chicken. In human, meningitis is the most common of the three forms of listeriosis.

AVIAN TUBERCULOSIS

Avian tuberculosis is caused by the bacterium *Mycobacterium avium*. This bacterium is closely related to the bacteria that cause human and bovine tuberculosis. In bird species, *M. avium* causes a chronic debilitating disease with tubercular nodes. In humans, infection with *M. avium* will typically cause local wound infections with swelling of lymph nodes in the region of the infection. Infection with this bacterium is extremely rare and is of most risk in severely immunocompromised individuals. Infection in humans is caused by ingestion of food or water that has been contaminated with feces from infected birds (called "shedders"). Most *Mycobacterium* infections are treatable with antibiotics, but *Mycobacterium avium*, highly resistant to antibiotics, is the exception. Surgical excision of infected lymph nodes is often necessary to eliminate the infection. Poultry flocks with this disease must be euthanized because no treatment is available. Fortunately, *M. avium* is not found in the commercial poultry industry today, but rare cases are found in small flocks where birds are held for several years.

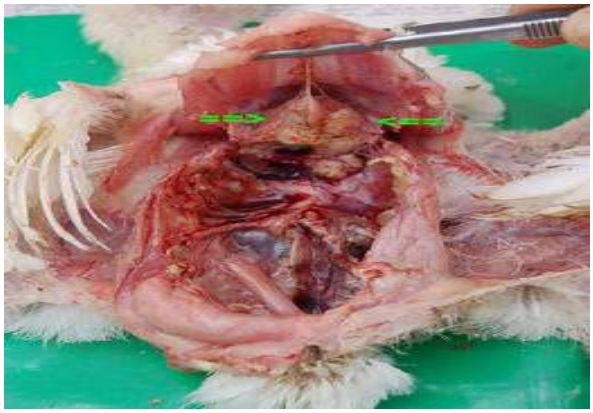


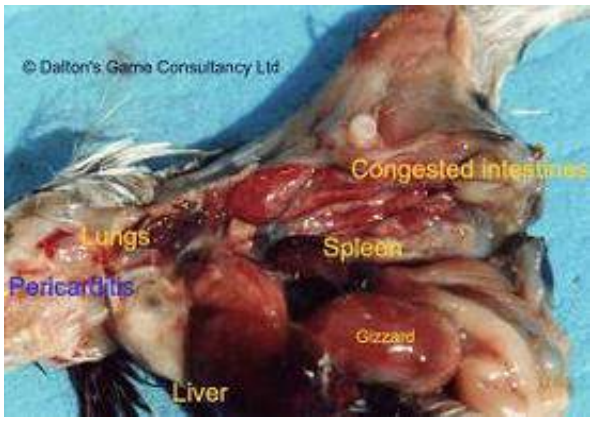
Lesions of Avium Tuberculosis

COLIBACILLOSIS

Colibacillosis is caused by an *Escherichia coli* infection. Like *Salmonella*, *E. coli* are found in the intestinal tract and on the skin of animals and are part of the normal bacterial flora. *E. coli* strains vary considerably in their ability to cause disease. Many strains are not pathogenic, but some can cause disease. Eating food that has been contaminated with a virulent strain can result in severe illness. In poultry, most *E. coli* infections are a result of complications and the *E. coli* are considered opportunistic agents. In poultry, *E. coli* may cause septicemia, chronic respiratory disease, synovitis, pericarditis, infectious cellulitis, and

salpingitis. Humans with *E. coli* infection usually present with diarrhea and a possible fever. Complications for less common types of *E. coli* infection include dysentery, shock, and purpura (purple rash). The incubation period is 12 hours to 5 days, although most cases will develop within 12 to 72 hours. Treatment of most cases of *E. coli* involves treating the diarrhea and dehydration that can occur. More severe cases may require the use of antibiotics or other drugs and hospitalization. Antibiotic resistance is a major problem when treating *E. coli* infections.





DISEASE PREVENTIVE MEASURES

The health of backyard poultry may be improved by implementing basic biosecurity measures, improving hygiene, educating owners about the most common diseases and their clinical signs, regular observation and handling of the birds by the owner, increased use of endo- and ectoparasiticides and increased use of vaccination. Bird-keepers should be aware that they can contract certain illnesses from their birds. The frequency of disease transmission from birds to humans is low, but the very young, the elderly, and those with compromised immune systems should be cautious. Many of these diseases are transmitted by ingestion of food contaminated by faecal matter. Prevention of most of these diseases, therefore, simply involves proper hygiene and sanitation. Wearing a face mask to avoid inhaling bird dust is also recommended. If you have persistent flu-like symptoms when no one else you know is affected, see a doctor and mention that you raise birds. Such symptoms may be indicative of a disease spread from birds to humans.