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Contents

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FOOD HABITS OF DIFFERENT SOCIO-ECONOMIC BACKGROUNDS OF ADOLESCENT GIRLS IN SAMASTIPUR DISTRICT, BIHAR

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Nutritional status of adolescents of developing countries like India is poorer as compared to developed countries. There are various factors which affect adolescent's health and nutritional status directly or indirectly such as inadequate nutrition, lack of awareness about health and nutrition, early marriage, high migration rate etc.

In Bihar, adolescent girls are suffering from serious health problem due to socio economic conditions, nutrition and gender discrimination. According to National Nutrition Monitoring Bureau (2003), in the rural area more than 40-50 per cent girls have been reported to be undernourished and iron deficiency anaemia is about 70 per cent (jayshree 2017).

Analysis of food habits helps in understanding the trend and in knowing the demand and supply gaps of food in the state. It also throws light on the nutritional aspects and helps in promoting certain required foods among the citizens.

Food Habits of Adolescent Girls

Study was carried out on 15-19 years age group of adolescent girls. Total number of adolescent girls was 100 and they were classified into three different groups' i.e. upper class (78), middle class (14) and lower class (8). Data in (Table 1) implied that out of total 100 respondents, 64 per cent of the respondents were non-vegetarian in each income class. Remaining respondents were vegetarian and ova-vegetarian 27 and 9 per cent respectively. Regarding frequency of skipping meal, it was found that majority of respondents were missing breakfast (53%) than lunch (37%) and dinner (10%). It showed that 52.56, 37.18 and 10.26 per cent adolescents belonged to lower class family who were missing breakfast, lunch and dinner respectively, while 50, 35.71 and 14.29 per cent of middle class adolescents were

missing breakfast, lunch and dinner respectively. Whereas 62.5 and 37.5 per cent respondents of upper class group missed breakfast and lunch respectively. Majority (53%) of respondents preferred fast food daily in each income class. Only nine per cent adolescents ate fast food on rarely basis. Overall 26 per cent adolescents were eating fast food on alternate days whereas 12 per cent selected subjects preferred fast food outside home once in a week.

The results of current investigation are supported by Kumari (2012) who presented her study in adolescent girls from different income groups in Patna, Bihar, where fast food consumption and breakfast skipping was assessed. The study implicated that almost every adolescent girls consumed fast foods. However, the selection of food items was strongly dependent on different income groups. Although, skipping breakfast and snacks was also more in adolescent girls.

Table 1: Food habits of selected adolescent girls

S.No.	Particulars	Socio economic groups						Overall N= 100	
		Lower class n=78		Middle class n= 14		Upper class n= 8			
		F	%	F	%	F	%	F	%
Food habits									
1	Vegetarian	21	26.92	4	28.57	2	25.00	27	27.00
2	Non-vegetarian	51	65.39	9	64.29	4	50.00	64	64.00
3	Ova-vegetarian	6	7.69	1	7.14	2	25.00	9	9.00
TOTAL		**78**	**100.00**	**14**	**100.00**	**8**	**100.00**	**100**	**100.00**
Meal skip									
1	Breakfast	41	52.56	7	50.00	5	62.5	53	53.00
2	Lunch	29	37.18	5	35.71	3	37.5	37	37.00
3	Dinner	8	10.26	2	14.29	-	-	10	10.00
TOTAL		**78**	**100.00**	**14**	**100.00**	**8**	**100.00**	**100**	**100.00**
Desire to eat fast food									
1	Rarely	6	7.69	2	14.29	1	12.5	9	9.00
2	Daily	45	57.69	5	35.71	3	37.5	53	53.00
3	On alternate days	20	25.64	4	28.57	2	25	26	26.00
4	Once a week	7	8.98	3	21.43	2	25	12	12.00
TOTAL		**78**	**100.00**	**14**	**100.00**	**8**	**100.00**	**100**	**100.00**

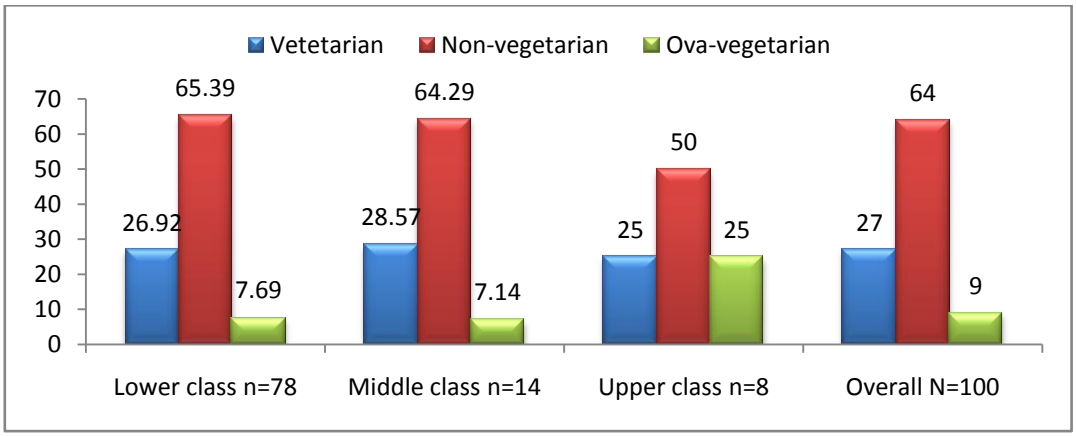

Fig 1: Percentage distribution of the respondents by their food habits

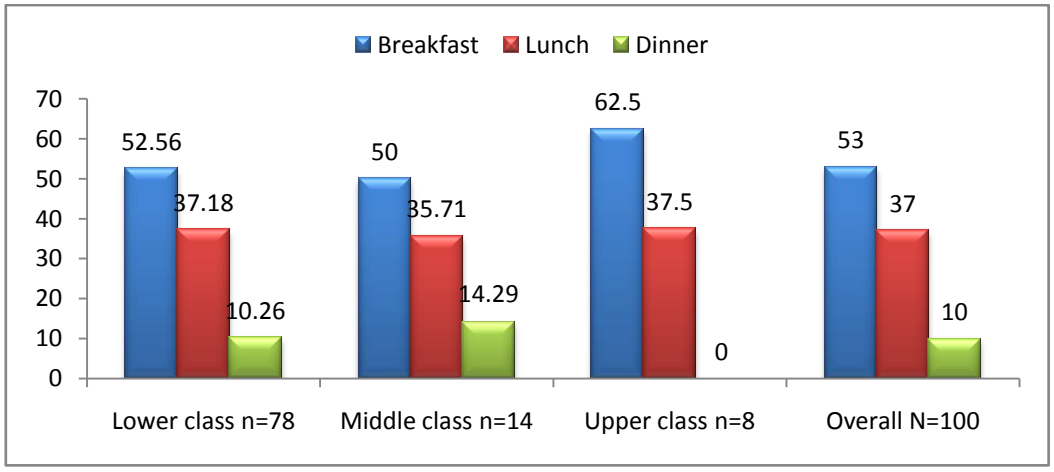

Fig 2: Percentage distribution of skipping meal by the respondents

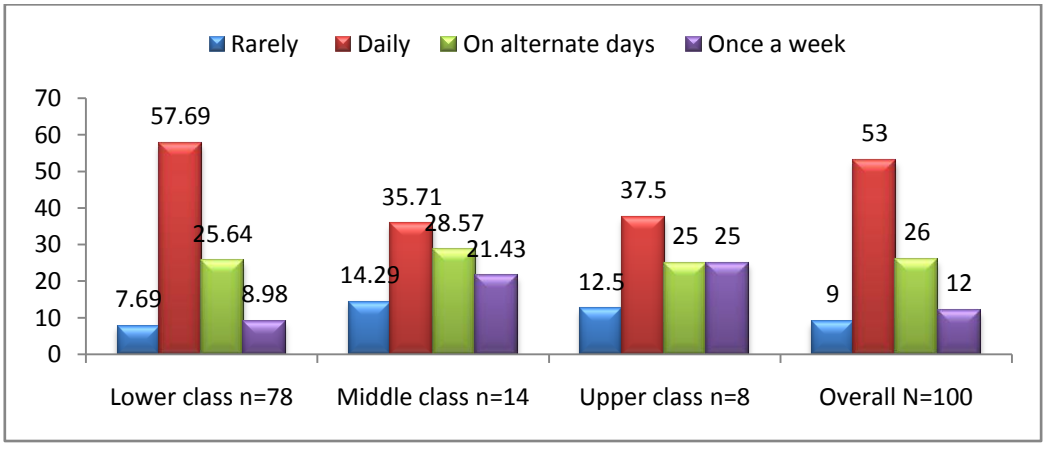

Fig 3: Percentage distribution of consumption of fast food by the respondents

Conclusion

It was observed that almost every adolescent girl in each economic group preferred consuming fast foods as compared to any other food groups. Skipping breakfast and snacks was also more in those selected girls. Most of the girls of every income class preferred tea and carbonated beverage on daily or alternative basis. Average daily intake of food stuffs and nutrients by respondents was very less in comparison as per the required recommended values. It was also showed that micro nutrients especially iron, folic acid, vitamin c and calcium were minimally included by each income group respondents in their daily diet. Among all food groups, milk and milk products, pulses, green leafy vegetables and fruits were less consumed by respondents of every socio-economic group. It was observed that the poor nutritional status of adolescent girls was found low in each income group irrespective of their class.

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RETENTION OF RURAL YOUTH IN AGRICULTURE

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The existing situation of rural youth engaged in the agricultural sector, becoming a threat against the improvement of agricultural sector performance in the future, is the rural young generation's low interest in and motivation to work in the agricultural sector. The data shows that, the maximum number of operational land holders (33.7%), belonged to the age group of 41-50 years, followed by 33.2 per cent in the age group of 51-60 years out of 100 million farmers in India. While this generation is reaching the age of retirement, the next one does not want to farm (Mahapatra,2020).

Many young farmers are taking over high-risk high returns agri-ventures like protected agriculture, precision farming, organic agriculture, floriculture, medicinal and aromatic plant cultivation, food processing, value addition, agro-tourism, etc. which are mostly avoided by the aging farmers. These new agri-ventures should be actively supported by the government agencies and financial institutions with skill training, financing and marketing support.

Youth participation in agriculture can solve the crisis of unemployment and migration. Questions required to be answered are whether the agriculture sector has enough prospects to provide decent livelihoods to youth, how youth are motivated to take up farming and farm-related businesses, and most importantly, whether leveraging youth for agriculture is an instrument for modernization and future growth of Indian agriculture. (Sukanya Som, *et. al.*, 2018).

Retaining rural youth in agriculture is critical for Indian farming. Most of the innovations (both technical and institutional) required a talented agriculture workforce. Young farmers and producers often have a greater capacity to adopt innovation and entrepreneurship than older farmers. The genuine solution is to take a position of "the rural

youth of today, the farmers of tomorrow". Based on study findings of 21 retention indicators to formulate the "Perspective model of the twenty-one-point programme on retention of rural youth in agriculture" are expected to contribute significantly towards the worldwide and national efforts of skyrocketing production and ensuring food security through increasing rural youth retention in agriculture,

The rural youth (male and female) with the age group of 16-30 years who must have been engaged in agriculture farming was considered respondents in this study.

For the measurement of the retention index of rural youth in agriculture, the procedure adopted by (Anamica,2013)was used with necessary modifications. For systematic and accurate measurement of the retention index of rural youth in agriculture.The 21 major indicators with 77 sub-indicators selected on the basis of the result 98 experts or judges of different institutions.

The finishing inventory of indicators was subjected to expert opinions. The experts or judges were from the cadres of Assistant Professor and above in teaching, research and extension faculty of social science group of Dr. PDKV, Akola and other agriculture universities throughout India and scientist working in ICAR Institutions.

The actual facts were collected personally with the help of a structured pre-tested interview schedule and data were analyzed by suitable statistical methods to get a meaningful interpretation and obtained each indicator score used for the groundwork of prescriptive model of the twenty-one-point programme on Retention of Rural Youth in Agriculture (RRYA).

Table 1: Indicator-wise Retention Index Score

Sl. No.	Retention Indicators	Mean Index Score
1	Skill development	76.00
2	Family income	75.80
3	Affiliation	75.60
4	Intrinsic motivation	75.40
5	Autonomy (Self-sufficiency)	75.20
6	Access to market	75.00
7	Quality education	74.40
8	Access to technology	74.40
9	Employment policy	74.40
10	Perception	74.20
11	Access to agricultural input	73.40

12	Aspiration	73.40
13	Health care services	73.00
14	Exposure to agribusiness management	72.60
15	Reward and recognition.	72.60
16	Social support	72.40
17	Access to farm mechanization	71.80
18	Access to finance services	70.40
19	Government schemes	70.20
20	Access to digital technology	69.60
21	Agricultural policy	69.00

Finally, the composite retention index worked out was (73.00). The indicator-wise discussions of the retention Index are presented below.

Prescriptive process model on retention of rural youth in agriculture (Fig.1) based on the field experience and major findings of research outcome.

The prime challenge for the stakeholders is "How to retain rural youth in agriculture". Keeping in view the outcome of the study, an attempt was made to retain rural youth in agriculture. The prescriptive model is multidisciplinary, focusing on all the possible ways and means for retaining the rural youth in agriculture and providing them handhold support to stay in agriculture

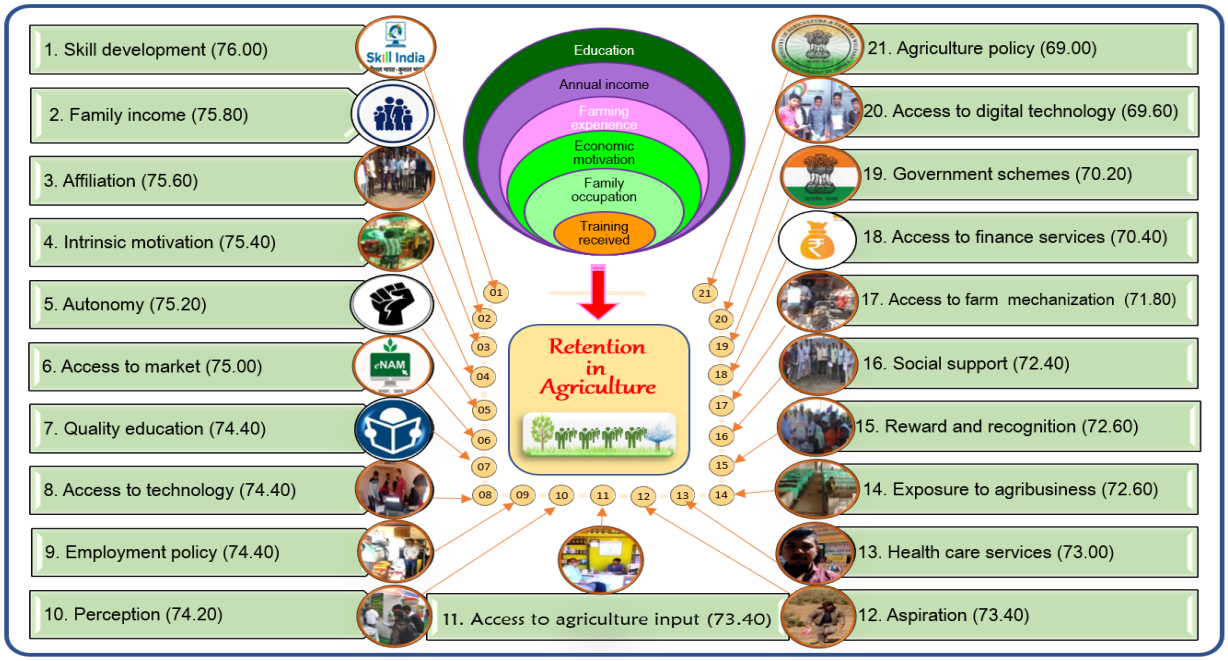

Fig. 1: Prescriptive model of the 21-point programme on retention of rural youth in agriculture

Conclusion

In this study, for measurement of retention of rural youth in agriculture retention index was developed and standardized, on the basis of results of retention index proposed a model on "Twenty-one-point programme on retention of rural youth in agriculture" this model consists of 21 indicators viz., skill development, family income, affiliation, intrinsic motivation, autonomy, access to market, quality education, access to digital technology, employment policy, perception, access to agricultural input, aspiration, health care services, exposure to agribusiness management, reward and recognition, social support, access to farm mechanization, access to financial services, government schemes, access to digital technology and agricultural policy. These indicators are very important in the development of a project or programme. Therefore, it is implied that policymakers, development agencies and extension functionaries should consider these indicators while preparing and planning programs or projects for the development of rural youth.

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BLACK CARBON IN SOILS: RELEVANCE, ANALYSIS, DISTRIBUTION

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Black carbon (BC), a graphitic, particulate form of carbon that results from the incomplete combustion of organic material, is a significant part of the soil organic carbon (SOC) in soils worldwide. Burning biomass and fossil fuels releases black carbon in the form of soot, char, and charcoal in soils and the atmosphere. It is pervasive compared to other SOC components, BC is less reactive and more persistent in soils. Important implications for nutrient storage result from its stability as well as chemical and physical characteristics including high surface area and porosity. Black carbon poses a particular threat to human health due to its minute size. In addition to having an effect on human health, black carbon also reduces visibility, damages ecosystems, lowers agricultural production and hastens global warming. The BC particles that give soot its black appearance intensely absorb sunlight. As a result of the incomplete combustion of fossil fuels, biofuels and biomass, BC is created both naturally and through human activity. The main contributors include wood burning, cook stove emissions, diesel engine pollution and forest fires. Black carbon is 460–1,500 times more effective than CO_2 at absorbing heat or warming the atmosphere. Black carbon, which is floating in the atmosphere, causes warming by converting solar radiation into heat. Additionally, it affects regional circulation and rainfall patterns, as well as cloud formation. Production of biochar BC and its storage in soils are considered to be particularly effective methods for sequestering carbon. Due to the continuum of materials found in BC, numerous analytical techniques, such as optical, chemical, and thermal ones, have been developed for its examination. This makes it challenging to evaluate research side by side and to construct a comprehensive picture of BC distribution. An assessment of black carbon in soils would be helpful to pinpoint the variables and processes impacting BC in soils and perhaps offer a critical tip for comprehending the global carbon cycle.

Formation of Black Carbon

The chemical structure of BC is highly aromatic, and carbon can form manifold forms of solid structures because of its ability to occur in different hybridization state. The BC created by vegetation fires frequently comprises of stacks of a few randomly oriented graphitic layers. The short-, medium-, and long-term orders of BC are influenced by factors such fuel moisture content and temperature during combustion. Combined with ozonation experiments, Fourier transform infrared (FTIR) spectroscopy was used to examine the structure and reactivity of BC (Akhter et al., 1985).Due to drastically expanded deforestation, changed agricultural practises and the burning of coal and oil for industrial energy supplies, BC production has surged over the past several centuries. These sources have different regional and temporal distributions based on the eco-system, climate, living conditions, and population density. The seasonal fire season influences the annual cycles of vegetation and fossil fuel combustion, with winter being the peak season for household heating. Fossil fuel combustion is a significant source of BC.

BC And Soil Organic Matter Composition

It has been suggested that the presence of BC is a source of highly fragrant components of soil humic acids that may be extracted from soils (Haumaier and Zech, 1995). In his 1983 study, Klmada contrasted humic acids made from burnt materials with those found in soil. The highest concentrations of humic acids were found in charcoal samples taken from soil horizons, followed by samples taken from bonfires. According to Klmada's (1983) theory, the carbonaceous byproducts of plant combustion weather naturally to produce some of the humic and fulvic acid component. According to Takahashi et al. (1994), burning plants was a significant contributor to the development of deep black soils. Several researchers have discovered that blackish, coal-like particles with sizes between 2 and 10 gm frequently exist and have a cellular structure. Many typical Chemozems and other soil types with dark A horizons include these particles. (Beck *et* al., 1982). Additionally, there is indirect proof that BC in soils like volcanic ash soils and Chernozems produces extremely fragrant humic acids (Kononova, 1966). Humic acid contents increased in the following order in a systematic investigation of soils: grey forest soils, dark grey forest soils, and chemozems (Kononova, 1966). Overall, these findings lend more credence to the idea that soil organic matter's chemically stable aromatic components are derived from burnt organic molecules. It

appears that soils that have been continuously burned contain a significant quantity of BC and frequently have a black tint.

BC as a Potential Sink in the Global Carbon Cycle

BC is one of the most resistant forms of reduced carbon toward chemical oxidation and is often found in sediments and soils. Due to its high anticipated production rates and excellent resilience to degradation, BC may make up a sizable fraction of the organic carbon buried in sediments (Kuhlbusch and Crutzen, 1995). BC must either be rapidly building up in soils and terrestrial sediments or must be mineralized in these environments by severe oxidative mechanisms if it is not being transported off the continents at this fast pace. Oxidation of BC in soils is known to be caused by microbes. Vegetation fires are hypothesized to act as a sink for atmospheric CO_2 as a part of the global carbon cycle (Kuhlbusch and Crutzen, 1995). Not all of the CO_2 released by the combustion of fossil fuels and biomass is accounted for by the increase in atmospheric CO_2 concentration since the start of the industrial revolution. Some of this CO_2 is absorbed by the ocean in the form of carbonates and bicarbonates but this does not fully offset the estimated CO_2 emissions. One key sink for the missing carbon has been proposed as an increase in plant CO_2 absorption. BC's contribution as a sink in the global carbon budget was evaluated by Seiler and Crutzen in 1980.

Persistence in Soils

Black carbon is very stable in soils, but it is not inert. That conforms to our understanding of microbial decomposers and their ability to decompose, as long as temperature, humidity and aeration are acceptable and it has frequently been observed in the extremely old fractions of SOM. It is well acknowledged that BC must be somewhat deteriorated (Schmidt, 2004), if not, our soils would have massive layers dating back to the comparable ancient BC. However, compared to non-BC SOM, the decomposition rate of BC is much lower. Chemical recalcitrance resulting from BC's aromatic structure, high molecular weight that prevents microbial ingestion and hydrophobic nature are the key factors for the substance's stability in soils (Bachmann et al., 2008).

Adsorber for Nutrients and Contaminants

Charcoal, or so-called "biochar," has a high surface area due to its high porosity, which makes it a good adsorber for pollutants and nutrients. The solutes are physically and

temporally trapped in the charcoal particle's micropores, causing them to precipitate if the water phase evaporates and adhering to polar and nonpolar adsorption sites respectively. In field tests, adding charcoal to soils could increase their fertility (Nehls, 2002). In sandy soils, charcoal can also function as a preferred adsorber for heavy metals.Not only biochar BC, soot BC is a good adsorber for hydrophobic contaminants such as polyaromatic hydrocarbons (PAHs) in soils and sediments (Gustafsson and Gschwend, 1997). Reaction with BC results in a reduction in desorption and bioaccumulation rates, limited biodegradation, potential transport of adsorbed contaminants through the soil.

Black Carbon Analysis in the Lab Methods

BC is studied in atmospheric, oceanic and soil sciences. Hammes et al. (2007) introduces the quantitative and qualitative BC analysis methods used in soil science and compared them based on ring trial results. Three of the methods are described in the following sections-out of three, two uses the chemical resistance

- The Benzene Polycarboxylic Acids (BPCA) Method
- Acid Dichromate Oxidation (Cr2O7) Method
- Chemical Thermal Oxidation (CTO 375) Method

Identifying Black Carbon in the Soil Profile

Forest, shrub and grassland fires can all serve as natural supplies of char and charcoal. Burning fossil fuels and biomass are recent and ancient human sources. Strong evidence for anthropogenic effects at the site can also be seen in distinct accumulations of coarse charcoal residues in the soil strata. They could serve as markers for char-burning locations or offer hints for old or historic towns. With particle diameters ranging from 2 to 10 m, BC may also be scattered quite evenly in the profile, as seen in Chernozems, in addition to conspicuous accumulations of coarse charcoal particles. To find burnt plant remnants in the field, a straightforward light microscope is helpful. The char contains preserved plant cellular structures that can be seen.A larger perspective clearly shows that BC darkens the colour of soil horizons. Schmidt et al. (1999) studied a 10 km colour sequence of chernozemic soils and discovered that, aside from BC concentrations, the soils were chemically and physically comparable and that the colour is mostly produced by varying BC contents. The earth may also be stained by soot accumulations from the past or present. These colored topsoil layers are primarily found around roadways and in populated areas, but they can also be found near

current or former train tracks because locomotive soot emissions then were much higher than they are now.

Distribution of Black Carbon in Soils

Black carbon is present in all soils and the atmosphere. It builds up more heavily in areas with frequent vegetation fires and close to areas where a lot of fossil fuel is used. Every climatic zone, from boreal woods to tropical rain forests, from prairies to high mountain regions, has recorded the accumulation of BC in soils (Deluca and Aplet, 2008). Black carbon has been found in both the arctic and metropolitan atmospheres.

Conclusions

Since the Devonian, black carbon has come from burning vegetation, and more recently, it has come from burning fossil fuels. BC has been widely dispersed via fluvial and atmospheric transport to become a practically universal component in soils, lacustrine and marine sediments. Combining short-term lab tests with field tests where BC has already been exposed to weathering and biological activity for decades, centuries, or millennia would be a promising strategy. Analysis has mostly focused on determining bulk features, such as micromorphology, elemental composition, isotopy and chemical structure, to determine BC origins. BC is relatively resistant to environmental degradation processes. Dark-colored soils, especially those impacted by regular vegetation or fossil fuel burning, appear to be abundant in BC. Understanding the processes involved in BC degradation is essential for calculating the BC stocks in soils and sediments. Analytical methods that clarify degradation processes at the molecular level are necessary for practical advancement in calculating BC degradation rates on a global basis.

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POLY4- A GAME CHANGING FERTILIZER

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This product made from mining polyhalite in coastal locations is known by the trademark name POLY4. The Crop Nutrients business corporation of Anglo American is responsible for marketing this product. Four of the six important macronutrients necessary for plant growth can be found in polyhalite, a naturally occurring fertilizer that has low levels of chloride and is multi-nutrient rich. For farmers, using POLY4 as a source of potassium, sulphur, magnesium, and calcium results in more effective fertilizer methods that are also more sustainable.

Solubility: All fertilizers are characterized by their solubility in water at a given temperature. The solubility of POLY4 was tested over a range of temperatures against the water solubility reported for other common fertilizers (Gangolli 1999). POLY4 has a solubility of 27 g L^{-1} at 25°C, which corresponds to the amount of POLY4 that would dissolve in the plough layer of a moist soil at 3 times to potash application rate(NRM Laboratories 2014, 2015). With this solubility, POLY4 effectively delivers K, S, Mg and Ca at commercially-required rates.

Summary of commercial fertilizer solubility at 25°C (Gangolli 1999):

Fertilizer	**Solubility at 25°C (g L^{-1})**
POLY4	27
MOP	264
Urea	1200

Dissolution Rate: The rate at which a solid transitions into a solution is known as dissolution. As crucial as when to apply fertilizer is the availability of nutrients to plants.

According to the findings of many studies, nutrients were released from POLY4 granules in 40 hours (Elam et al., 1995).

Nutrient Delivery Profile: Nutrients including nitrogen, potassium and sulphur are frequently added as fertilizer during planting. When a plant is nearing the conclusion of its life cycle, when nutrient uptake is at its peak, these nutrients may have been lost due to erosion, runoff, or leaching. Crops grown on sandy soil and other soil types with low capacity to hold and release nutrients require sustained nutrient release more than other soil types. POLY4 offered a very potent and distinctive combination of prolonged K, S and Mg release that enables plants to benefit from this availability for a longer period of time, better meeting their needs.

Key Points of Choosing POLY4 over Another Fertilizer

a) POLY4 is an Efficient Multi-Nutrient Fertilizer: According to trial results, POLY4 has improved nutritional absorption for both macro and micro nutrients. More nutrients being transported to the crop results in higher yields and higher crop quality, which is a major source of profit. In addition to lowering fertilizer and other farm input costs, POLY4's multi-nutrient features also assist farmers reduce nutrient waste by distributing nutrients over a longer period of time that is more in line with plant needs.

b) POLY4 is an Effective Multi-Nutrient Fertilizer: POLY4 increases yield, quality, and nutritional health by making a wider range of nutrients more readily available to plants. It can also reduce crop losses through disease resistance. These macro and micro nutrients also become accessible over a longer period of time, better fitting the plant's nutrient uptake cycle. All of the main input sources for NPK blending are compatible with POLY4, which is offered in granulated or standard form. A POLY4 mix may be stored for a lot longer than a regular NPK blend. Up to 36 metres away, this product spreads efficiently, eliminating uneven fertilizer application and a subsequent decline in crop yields (Chinese Academy of Sciences 2015).

c) POLY4 is A Flexible Multi-Nutrient Fertilizer: POLY4 avoids the toxicity problems typically connected with the use of high-chloride fertilizer sources because it is a low-chloride, multi-nutrient fertilizer. An improvement in the soil's chloride content is beneficial to several crops. Additionally, POLY4 has no negative impact on soil's electrical conductivity, which can be hazardous to crops.

d) POLY4 is a Sustainable Fertilizer: By making soil more resistant to compaction, erosion, and runoff, POLY4's calcium helps plants obtain the nutrients they require to grow. Applying the wide range of nutrients that POLY4 provides can increase the plant's access to soil-bound nutrients and stop nutrient mining, a frequent danger to the sustainability of agricultural production. Polyhalite's use leaves a little carbon impact and gives farmers a productive fertilizer option.

Why we choose POLY4 in India?

- ✓ It is acknowledged that soils are deficient in potassium, sulphur, and magnesium.
- ✓ The current system of subsidies promotes nitrogen overapplication.
- ✓ Degradation of soil nutrients and the need for more balanced fertilisation.
- ✓ Low yields and poor fertilising methods.
- ✓ To lower chloride content, there is a demand for a balanced application.
- ✓ By supplying potassium, sulphate and magnesium in one product and enhancing nutrient delivery profile, POLY4 offers a corrective and environmentally responsible option.

POLY4 –Global crop performance

i) Rice- Rice has the second highest worldwide production after corn. Between 2012 and 2016, global rice production increased by 4.7 Million metric tonnes (Mmt) and POLY4 as a potassium source increased yield on average by 4% up to a potential 22% yield improvement over MOP (FAOSTAT 2017)

ii) Corn- On average, an MOP + POLY4 blend generated a 7% yield improvement with a potential to increase yield by up to 14% in the United States, Brazil, Europe, Africa, China and Vietnam(FAO 2016)

iii) Soybean- The global agronomy programme shows that the average yield is increased up to 7% with MOP + POLY4 blend application (USDA 2017)

iv) Potato- In the United States, UK, Brazil, and India, testing on the potato were conducted on a global scale. To economically maximise yield and quality, POLY4 is a low-chloride K source that satisfies the crop's S and Mg needs. Data gathered from several sources revealed that POLY4 treatments increased yield over SOP applications by an average of 4%. (2018 Sardar Vallabhbhai University of Agriculture and Technology)

v) Tomato- Tomato is the most consumed vegetable worldwide. The largest producers were China, the United States and India. Trials showed that POLY4 treatments improved yield over MOP applications with an average yield gain of 18% (FAOSTAT 2017).

Future Strategies and Conclusion

POLY4 is a naturally occurring, low-chloride and certified for organic use. It includes a variety of essential micronutrients as well as four of the six nutrients plants require to develop. With one straightforward product, it is an efficient fertilizer that enables farmers to maximise crop yield, raise crop quality, and enhance soil structure. Because POLY4 is made from a natural mineral and does not undergo any chemical processing, it differs from the majority of potash fertilizers. This backs up the organic registration of POLY4. SOP has a salt index of 97, MOP has 130, and POLY4 has a salt value of 76. POLY4 is a pH-neutral fertilizer that has no impact on the pH of the soil. By using POLY4 in fertilizer regimens, the acidifying impacts of other nutrient sources like ammonium sulphate may be lessened.

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INLAND AQUACULTURE PRACTICES AND OTHER SCHEMES

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The internship with practical training has been very helpful for manual handling, knowledge, confidence and sharpening the skills, and made aware of the prevailing problems in the fishery sector, and also to look forward for solution in future planning. Through this training programme we came to know about the state fisheries department, their contribution to the growth and development of the inland freshwater aquaculture and the financial growth of the fish farmers and the state government as well as their economical contribution to the country. Through this internship programme we got an opportunity to interact with professors, fish farmers, professional lab instructors and officials; in their day to day life and allied activities.

India is the country that produces the most fish worldwide. The Indian Blue Revolution showed how important the fishing and aquaculture industries are. The industry is regarded as a sunrise sector and is anticipated to have a big impact on the Indian economy soon. From 0.75 million MT in 1950–1951 to the current production of 141.64 MT, fish production in India has increased dramatically. Up until 2019-20(Department of Fisheries, States Government / UTs Administration), marine fish production accounted for the majority of the country's overall fish production. However, inland fisheries in India have witnessed a reversal due to the application of science-based fisheries and now provide almost 70% of the nation's total fish production (Katiha*et al.*, 2005). Therefore, through the holistic approach adopted under PMMSY (Pradhan MantriMatsyaSampadaYojana), inland fisheries offer immense opportunity and potential to enhance production through optimal utilization of fisheries, technology infusion and capacity building (Mohanty, 2010). The aquaculture industry has seen commendable growth in Tripura state in recent years, and fish productivity has improved significantly. The state has a lot of water space that is used for cultured and

harvested fisheries, which is a significant potential resource. Fish are produced in two different sectors: cultivation (74434.85 MT; average productivity: 2717 kg/ha/yr) and capture (2528.24 MT). Tripura produces more carp seeds than it needs, and these seeds are sent to states nearby. However, there is a small production and demand deficit in the fish industry, which is filled by importing 11528.35 MT of fish from Bangladesh and 12040.00 MT from other states. India has the largest per capita fish intake. So, that's why further study and training on this inland fisheries will enhance our knowledge and to start up in near future and helping to build the nation. So in this project we have done various type of training like netting breeding programme, area and production of fingerlings, cage culture, pond and bio floc techniques under Tripura Fisheries Training Institute and Krishivan Research Centre for Entrepreneurship Development and Environment, Dehradun, U.K.

Management of Fish Ponds

The availability of land for a fish pond and high-quality fish seeds is a prerequisite for fish culture. Although seed output may be sufficient, it is important to have a solid understanding of how to raise those delicate newborn fish in well-managed nurseries, ponds, and stocking areas. Most government-run fish farms and forward-thinking farmers have the aforementioned kinds of fish ponds. However, the primary goal of the farms/projects is to produce table fish or fish seeds.

Generally, in scientific fish farming number of various sizes of ponds (as stated above) are required for rearing of various stages of fishes namely:-

Nursery pond - rearing of Spawn to Fry stage (approx. Size 4- 15 mm)for about 15 days.

Rearing pond – rearing of fry to fingerling stage (approx. Size: 16-40 mm)for about 2-3 months.

Stocking pond- rearing of fingerling (approx. Size 41- 150 mm) to marketable sizes/ adult fishes.

Water Quality Testing

In order to maintain growth and survival, it is necessary to check the optimal water quality for each species. The health of the organism and the price of bringing a product to market can both be considerably impacted by the water quality in the manufacturing systems. Temperature, dissolved oxygen, pH, alkalinity, hardness, ammonia, and nitrite levels are

among the water quality characteristics that are frequently checked in the aquaculture sector. Salinity, chlorides, and carbon dioxide may also be observed, depending on the culture system. Alkalinity and hardness are two variables that are rather constant, however dissolved oxygen and pH are variables that change daily. For your specific circumstance, it is crucial to establish a uniform testing strategy for water quality.

The optimum pH for fish is between 6.5 and 9. Fish will grow poorly and reproduction will be affected at consistently higher or lower pH levels. The Effects of pH on Warm-Water Pond Fish pH Effects on fish 4 Acid death point 4 to 5 No reproduction 4 to 6.5 slow growth 6.5 to 9.

Testing pH of Pond Water with Universal Indicator

Process- Took 4ml of water sample in a test tube then added 2 drops of pH reagent then waited for 1-2 minutes then observed the colour of the sample & then matched to the pH colour chart. Result- 7.8.

Hatchery Technology

A fish hatchery is a facility used to artificially breed, hatch, and nurture young animals, primarily finfish and shellfish. The primary purpose of hatcheries is to produce larval and young fish, shellfish, and crustaceans that are transported to on-growing systems, like fish farms, to mature into harvestable sizes.

Chinese fish spawning facility

Chinese spawning and hatching methods rely on gravity-driven continuous water flow to raise carps and hatch their eggs. Compared to any other design for the same output capacity, a Chinese hatchery is less expensive to build and run. The Chinese hatchery system is currently regarded as being extremely suitable for the production of high-quality fish seed in India. This system is intended for the incubation and breeding of fish. One hatching operation takes 4 days to complete.

Hatchling Receiving Tank

This is a rectangular masonry concrete tank. The inside dimensions are 4 x 2.5 x 1.2 m. This is located at a lower elevation than the incubation pond, so as to drain out the water from it by gravity. Fresh water supply from the overhead tank is provided by a 7.5 cm

diameter pipe line, bifurcated into 3 numbers of 3cm diameter pipelines.These pipelines are arranged to provide the spray for aeration. From each of the incubation ponds 7.5 cm diameter pipes are provided for transferring and regulating spawn intake into the spawn receiving pond. Hooks are fixed in two opposite side walls of the pond for fixing the net for the collection of spawn. Steps are also provided for getting into the pond for the collection of spawn. The overflow from this pond is discharged into an open drain and suitably utilized in the earthen ponds, if possible.

Seed Production of IMC

IMC are bisexual (heterosexual) and sexes may be outstanding most effective at some point of the breeding season.

Induced Breeding

Induced breeding is a method whereby mature fish breeders are encouraged to reproduce in captivity by the introduction of pituitary hormone or any other synthetic hormone. It is also referred to as hypophysation. Major carps are the most significant species in terms of food and nutrition value. They have so maintained the interest of scientists and aqua producers. They have the odd habit of reproducing in swiftly moving rivers and streams where they have plenty of room to roam around.

Induced Breeding of Fishes with Ovatide

Ovatide is an indigenous, cost-effective and new hormonal formulation for induced breeding of fishes.

- It is also effective in breeding major carps. The doses for females are 0.20-0.40 ml/kg for rohu and mrigal, 0.40-0.50 ml/kg for catla, silver carp and grass carp. The dosages for males are 0.10-0.20 ml/kg for rohu, mrigal, 0.20-0.30 ml/ kg for catla and 0.20-0.25ml/kg for silver carp and grass carp. Synthetic compound launched by Hermmopharma, Bombay. Combined of GnRH analogue with dopamine antagonist pimozide.

Method of Injection

Usually two methods are adopted for injecting the brooder fish. They are intramuscular and intra-peritoneal.

A) This approach is very practical and efficient. The lateral line is avoided by injecting into the dorso-lateral muscle, which is directed toward the caudal peduncle. To lessen the physical burden on the fish, the pricks are made alternately on the right and left sides as two divided doses are administered for carp spawning. The needle is put beneath the scale in a straight line across the fish's body, and it is then twisted at a 45-degree angle to quickly penetrate the muscle and inject the fluid.

B) Intra-peritoneal Injection: This technique involves lateral placement of a brood fish atop a foam rubber cushion. In carps, an injection needle is placed into a soft area near the base of the pectoral or pelvic fin. Insert the syringe needle while angling it 45 degrees away from the body's longitudinal axis in the direction of the head. It is simple to use a 2ml hypodermic syringe with 0.1ml graduation.

Integrated Fish Farming

Integrated fish farming is a system of producing fish in combination with other agricultural/livestock farming operations centered around the fish pond (Dhawan, and Sehdev, 2020).

Advantages of Integrated Fish Farming

1. Efficient use of fish production wastes from various cultural practises.
2. It lowers the additional expense for fertilization and supplemental feeding.
3. There is no waste in this balanced artificial ecosystem.
4. It offers additional opportunities for work.
5. It boosts output and economic efficiency while reducing input.
6. In addition to meat (chicken, duck, cattle, hog, etc.), milk, vegetables, fruits, eggs, grains, fodder, mushrooms, etc., integrated fish farming also produces fish.
7. The output and socioeconomic standing of the less advantaged members of our society could be improved by this technique.

Types of Integrated Fish Farming

Basically the integrated fish farming is of two types

a) Agri-based fish farming
b) Livestock fish farming

The fish-cum livestock farming is realized as innovation for recycling of organic wastes as well as production of high class protein at low cost.

a) Aquaculture Based on Agriculture

1) The paddy—cum-fish Industry

When there is enough water in the paddy fields, this farming is done in the Indian states of Bihar, West Bengal, Orissa, and Assam. Three to eight months per year, the paddy fields retain water. Due to the usage of pesticides to safeguard high yielding paddy varieties, interest in this practise has decreased recently.

b. Livestock Fish Farming

1) Poultry-cum-fish farming

This system utilizes poultry droppings of fully built- up poultry litter for fish culture. The fish production obtained is about 5000 kg/ha/yr. with 1250 kg chicken meat and 70000 no. of eggs. Approximately 500-600 no. of birds is reared in a 1 ha pond. The Rhode Island or Leghorn variety birds are more preferred over others.

2) Duck-cum-fish culture

The duck are commonly called as biological aerator. They are reared on the dyke of the pond in a low-cost house. This farming is practised in Tamilnadu, Assam, Bihar, Andhra Pradesh, Tripura, Orissa, Karnataka, Kerala and Uttar Pradesh. The 'Indian runner' and 'Khaki campbell' varieties are found more suitable in this culture. About 300 no. of ducklings (some spp. are reared 450-500 in no.) are reared to fertilize the 1 ha. pond.

Biofloc Fish Culture

Biofloc technology is a technique of enhancing water quality in aquaculture through balancing carbon and nitrogen in the system

Design and specifications of biofloc systems Between feedings, "Flocs" are an additional food source that can be eaten (pellet use). One advantage of biofloc systems is their ability to recycle waste nutrients into fish or prawns via microbial protein. Nitrogen is a key ingredient in biofloc, and it is integrated into bacterial cells. The benefit of higher feed conversion ratios from consuming microbial protein is another advantage of biofloc systems.

As they provide the biggest advantages for pond-based aquaculture, bi-floc systems are typically used as pond-based systems (Crab, *et al.*, 2012).

Species Suitable for Biofloc Culture

Major cultivable fish species in BFT A basic factor in designing a biofloc system is the species to be cultured. Some of the species that are suitable for BFT are:

Air breathing fish like Singhi (*Heteropneustes fossilis*), Magur (*Clarias batrachus*), Pabda (*Ompok pabda*), Anabas/Koi (*Anabas testudineus*), Pangasius (*Pangasius sanitwongsei)*

Benefits of Biofloc Culture System

1. Eco-friendly culture system 2. It reduces environmental impact. 3. Improves land and water use efficiency 4. Limited or zero water exchange. 5. Higher productivity (It enhances survival rate, growth performance, feed conversion in the culture systems of fish).

Disadvantages of Biofloc Technology

1. Increased energy requirement for mixing and aeration
2. Reduced response time because water respiration rates are elevated
3. Start-up period required Alkalinity supplementation required.

Cage culture

Cage culture is an aquaculture production system where fish are held in. floating net pens. Cage culture of fish utilizes existing water resources but. Encloses the fish in a cage or basket which allows water to pass freely. Between the fish and the pond permitting water exchange and waste(Halwart*et al*., 2007).

Conclusion

Work experience in "Fisheries and Aquaculture," which is required as partial fulfillment of the B.F.SC degree programme, provides the chance to develop practical skills and gain experience in a variety of tasks related to the production of fish seeds, fish harvesting, and fish marketing, among other things. We had the chance to connect with professors, fish farmers, professional lab instructors, and authorities as they went about their daily lives and related tasks thanks to this internship programme. The project was undertaken

mainly on following topics i.e. Seed production of IMC, Induced breeding by hormone , Hatchery technology, Fish pond management, Water quality testing. The internship with hands-on training has been highly beneficial for manual handling, knowledge, confidence, and skill development. It has also made people aware of the current issues in the fishery sector and helped them plan for potential solutions in the future. Through this training programme, we learned more about the state fisheries department, their role in the expansion and advancement of inland freshwater aquaculture, the financial success of fish farmers, the state government, and their economic impact on the nation.

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