

Bio slurry Ultimate Choice of Biofertilizer

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Executive Summary

In Bangladesh, 27 million cattle and buffaloes available produce about 24 million tons of dung annually (FAO, 1989), but the above quantity is to be utilized in integrated cultivation to maintain the soil health. The matter is to be considered very seriously for the future management of dung and poultry manure for environmental concern and sustainable farming in the country.

IDCOL (Infrastructures Development Company Ltd) has been implementing NDBMP (National Domestic Bio manure program) program with support from government of Bangladesh and SNV Netherlands. About 24 thousand bio gas plants have been constructed in Bangladesh by them and under this program 60 thousand bio gas plants were planned to be constructed during 2006 to 2011 but fell below the expectation.

In Bangladesh major food crops tantamount to 3 million tons nutrient removal annually which is alarming for causing infertility in the soil? Depleted fertility stands against achieving a good return on even adapting intensive cultivation. Hence use of cow dung and poultry manure along with inorganic fertilizer should be the common practice in improving the soil and balancing other macro and micro elements needed by plants. Information on use of bio slurry on crops is inadequate showing the efficiency of cow dung and poultry slurries along with the optimum inorganic fertilizers can bring a good result.

Including 24 thousands set by IDCOL, a total of more than 25 thousand bio gas plants have been established by different agencies in different parts of the country for utilization of bio slurry. Researchers conducted by BARI in collaboration with institutions showed that bio slurry can be used as excellent organic fertilizer explaining the following situations:

a) The present soil fertility status of Bangladesh is alarming many macro and micro nutrients content are declining day by day causing imbalance in using inorganic manure and thus, application of IPNS. Bio slurry can play a vital role here.

b) Judicious integration of inorganic fertilizer along with organic manures may help to maintain soil fertility and crop production. It is also suggested that comparative performance of slurry composed with aerobically decomposed organic manure and integrated use of manure or slurry along with inorganic fertilizer for soil treatment produce very good results.

c) Recycling of organic matter is essential for maintaining soil fertility. So utilization of bio slurry is very important. But bio gas slurry plants were not properly managed in most cases which created unhygienic condition and polluted environment. So improvement of quality and efficiency of bio slurry composting can bring a good result.

Various programs had been undertaken on bio slurry as an option for renewable source of energy, the opportunity could not be utilized properly yet in Bangladesh although about 20'0000 tons of bio slurry has been produced every year in Bangladesh.

About 35 organizations are involved in transferring the bio gas technology with the help of IDCOL and SNV Bangladesh. They plan to

construct more than 4 million bio gas plants which if materialized can play a vital role in rural sector amidst persistent energy crisis. Bio slurry organic fertilizer is more effective than traditional organic fertilizer as it contains 20-30% more nutrient than commonly used organic fertilizer. Poultry litter contains appreciable amount of toxic heavy metal and contains more nutrients than cow dung (CD). Slurry composed has high manural value than bio slurry, so it is imperative to evaluate cow dung and Poultry Manure (PM) and their bio slurry as source of organic manure.

For the last four years BARI made extensive research work both on station and on farm for this project with devotion getting positive result of bio slurry as a manure of choice over other traditional and inorganic fertilizers. They have analyzed categorically on farm trial demonstration, pit preparation of bio gas, training session, collection of farmers' views and took initiatives for the capacity build up of the farmers. Table 1 shows the extensive trails conducted by BARI, using different type of fertilizers applying in different combinations from 2008 to 2011.

In light of the above trails conducted by BARI it is evident that air dried bio slurry contained higher organic matters than sun dried bio slurry (2009). Metal contents were within the safe limit in cow dung (CD) and Poultry manure (PM) slurry. Lead content was higher in Poultry manure (PM) than cow dung (CD). Moreover higher yield of crops with higher economic turnover was found with IPNS+PM slurry treatment. Same production of crops was obtained using 3 tons PM slurry compared to 5 tons of cow dung slurry.

Project research on bio slurry management and its effect on soil fertilizer and crop production was conducted BARI from 2008 to 2011 [1]. Maintenance of soil fertility is a prerequisite for long term crop production and it is certain that organic manure (CD, PM, and their slurry) can play a vital role in the sustainability of soil fertility and crop production.

Primary investigation showed that both cow dung and Poultry litter

Types of Fertilizers	Function
Manure Quality	Bio slurry & slurry composed / PM is more suitable for acid soil due to high lime content
Nutrient content	anaerobically cow dung (CD) slurry & PM were higher than aerobically decomposed CD & PM
6 Nutrient Management package	Inorganic fertilizer, IPNS with CD, IPNS with CD slurry, IPNS with poultry manure, IPNS with PM slurry, native fertility on Cabbage & Cauliflower & Indian Spinach -2009

Table 1: Extensive Trails Conducted by BARI.

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Received May 06, 2013; Published July 21, 2013

Citation: Aminul Haque ABM (2013) Bio slurry Ultimate Choice of Biofertilizer. 2: 738. doi: [10.4172/scientificreports.738](http://dx.doi.org/10.4172/scientificreports.738)

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slurry contain considerable quantities of plant nutrients which may be used to improve soil fertility and the use of chemical fertilizers can be reduced to a great extent. Poultry litter based bio slurry is especially suitable for acid soils as it has strong liming effect.

Overview of SNV IDCOL Program

Under the funding of the Netherlands Development organization (SNV), Infrastructure development Company (IDCOL) has started implementation of a project entitled National Domestic Biogas and manure Program (NDBMP) in Bangladesh since January 2006. The overall objectives of the program is to further develop and disseminate domestic bio gas plants in rural areas with ultimate goal to establish a sustainable and commercial biogas sector in Bangladesh. The project activity will continue up to December 2012. Under the programme, as many as 37,000 domestic sized biogas plants will be constructed. The use of bio slurry generated from these plants as byproduct are promoted and popularized among the biogas owners and farmers for land application.

BARI conducted extensive, untiring research work from 2008 to 2011 [1] in different regions of Bangladesh including on Station on farm trials of their own selecting a group of farmers on different crops and vegetables having financial assistance from SNV IDCOL. The outcome of their research work on bio slurry as fertilizer of choice that can be counted as farmers' voice DAE can play a major role on the basis of feedback information treated as farmers' voice of relevant areas to diversify the use of bio slurry and make necessary steps to popularize the product over chemical fertilizers throughout the country in all perspectives viz. cost, yield, availability, eco system friendly, increasing nutrient value of land, less intake of insecticides imported from abroad at the cost of our hard earned money.

In light of the above, given below the following remarks that can be treated as farmers' voice

- Highest yield of Carrot and cauliflower were achieved using bio slurry at Pabna Region.
- The Farmers were very happy having the highest yield of potato using bio slurry at Rangpur.
- Use bio slurry in the fishing ponds gave maximum production of fishes minimizing the cost of production at Sathkhira.
- The valued comment of the farmers are, the use of bio slurry in the production of vegetables don't require extra inorganic fertilizers.
- Vegetables produced using bio slurry gives better taste than that produced by inorganic fertilizers
- Since, cow dung in dumped condition is not decomposed properly and as a result losses its optimum power as manure. Bio slurry on the other hand gives a better response through proper utilization of manure and helps improve the condition of soil.
- DAE would take initiative to encourage the land owners & farmers to use more organic fertilizers (bio slurry) to bring back the nutrient contents of the soil at an acceptable level
- DAE would play a vital role to motivate the farmers and growers through demonstration and discussion exchanging their share of views of the superiority of IPNS+bio slurry combination for optimum production of crops with minimum expenditure favouring our eco system improving the soil condition (nutrient value) which is decreasing at an alarming speed every year.

Moreover, use of organic fertilizers make a gradual shift towards nature and decreases the risk of nutrients leaching.

- As bio slurry doesn't contain any harmful element it can easily be applied for all types of crops.
- Bio slurry reduces the growth of unwanted weeds compared to inorganic fertilizers and reduces labour costs to clean up.
- Bio slurry contains all the nutrients required for both land and crops and is the most appropriate manure.

Introduction

Bio slurry technology is becoming popular in rural Bangladesh in view of escalating cost of fuels as well as soaring prices of chemical fertilizers which our farmers find difficult to buy for their sustainable crop production. In Bangladesh Major crops remove about 2.98 million tons of nutrients against 0.72 million tons as replacement, that speaks we should encourage the people to use more organic fertilizers such as bio slurry to improve the soil condition which is friendly to eco system and helps maintain the equilibrium of nature. In the right perspective, organic fertilizer is cost effective giving higher yield of the crops than the inorganic one with less intake of insecticides imported for outside at the cost of our hard earned money. Besides, more use of inorganic fertilizers develops some sort of tolerance by the insects and simultaneously killing the microbes resulting in reducing the microbial activities of the organic fertilizers.

Bio slurry is aerobic digested organic manure released as by product from bio gas plant after production of combustible methane gas for cooking lighting, and running machineries. The raw materials used for bio gas plants in Bangladesh are cow dung poultry litter and other decomposable materials viz. kitchen refuse, farm wastes, water hyacinth and crop residues. Human excreta can be used for producing biogas and manure favoring our environment and sanitation but our people are not accustomed to using the same.

Importance of Bio slurry

The densely populated country like Bangladesh with limited cultivable land and resources forces the farmers to grow more food round the year meeting up the demand for millions of tummies through relentless pursuit using inorganic fertilizers in discreditably and thereby decreasing the nutrient value and content of the soil at an alarming speed without proper replenishment and ultimate disaster against the eco system. Moreover, inorganic fertilizers encourage use of insecticides for the control of pest that gradually develop some sort of tolerance towards increased dosages killing microbes and in the long run welcome hazards to the environment and community. An aerobically fermentation or decomposition is usually brought about by a special group of micro organisms called methanogenic bacteria. Bio gas production in the digester principally consists of 60-70% carbon dioxide and trace of different hydrocarbons, nitrogen, hydrogen sulphate.

Time is here when we have to encourage and educate the people about the diversified use of more organic fertilizers, in particular bio slurry to bring back the nutrient property of soil at an acceptable level, since due to continuous mining of nutrients the soil is losing its productive capacity at an endangering stage. Besides, organic fertilizers composed of natural ingredients from plants and animals create a healthy environment for the soil being friendly to ecosystem offering lush green vegetations over a long period of time while inorganic fertilizers that are composed of minerals and synthetic chemicals fail

to create a sustainable environment. According to the report of North Carolina State University, organic matters in natural fertilizers promote and environment conducive for earth warms and increase the capacity for holding water and nutrients. Organic fertilizers released nutrients slowly, relying on soil organism breaking down organic matters, a slow released scenario decreases the risk of nutrients leaching and gradually supplies nutrient to plants for a long term span and helps maintain "GREEN LIVING" .

Long term effectiveness of organic fertilizers

Research comparing organic and inorganic fertilizers provides compelling evidence that organic fertilizers bolster soil health over a long term. In a study conducted in Sweden over thirty two years, Scientists ARTUER GRANSTEDT and LARS KJELLENBERG reported on the differences in soil structure and crop quality between organic and inorganic system.

They found that soil in organic system had higher fertility, and organic crops had higher yields and starch content than the inorganic system. In contrast, long term use of synthetic fertilizers depletes soil organism of organic matter they need, states the Main Organic Farmers and Gardeners Association. Eventually, these organisms disappear in soil dependent on organic fertilizers

Use of Bio slurry: The ultimate organic fertilizer of choice

Biogas slurry, or effluent, consists in general of 93% water, 7% dry matter of which 4.5% is organic and 2.5 % is inorganic matter. The percentage of NPK (Nitrogen, Phosphorus and Potassium) content of slurry on wet basis is 0.25, 0.13 and 0.12 while in dry basis it is 3.6, 1.8 and 3.6 respectively.

In addition to the major plant nutrients, it also provides micro-nutrients such as zinc, iron, manganese and copper that are also essential for plants but required in trace amounts.

The bio-slurry coming out of the digester has the following characteristics:

- When fully digested, effluent is odor less and does not attract insects or flies in the open.
- The effluent repels termites whereas raw dung attracts them and they can harm plants fertilised with farmyard manure (FYM).
- Effluent used as fertilizer reduces weed growth with about 50%. When FYM is used the undigested weed seeds cause an increased weed growth.
- Composted effluent and effluent used as liquid fertilisers have a greater fertilising value than FYM or fresh dung. This because nitrogen is available in a form that can be immediately absorbed, for some crops it is superior to chemical fertiliser.

If bio-slurry is composted the nutrient value will be added into it. Digested slurry is an excellent material for accelerating the rate of composting of refuse, crop waste and garbage etc. The Table 2 shows the N, P, K values in different types of organic fertiliser:

It can be seen from the above table that digester bio-slurry has better nutrient values in comparison to other organic fertilisers. The effect of compost on crop production depends upon the type and condition of the soil, the quality of the seeds, climate and other factors. However, application of compost will bring the following changes to the soil:

- Improvement of the physical structure of the soil.
- Increased soil fertility.
- Increased water-holding capacity of the soil.
- Enhanced activity of the micro-organisms in the soil.

Effluent compost, if stored and applied properly, improves the soil fertility and increases cereal crop production with 10-30% as compared to Farm Yard Manure (FYM). The application of liquid effluent has proven to be very successful on paddy, wheat, maize cabbages, tomatoes, etc. The most responsive crops, however, to effluent compost are vegetables like root crops (carrots and radish), potatoes, fruit trees and rice (Kharif, India-1988).

Objectives of the Article

The farmers and rural people should be properly informed of plant nutrient value and heavy metal concentration of bio slurry from different organic substrate and extension of message available in our country.

To ascertain the economic advantages bio slurry over inorganic fertilizers both in yield and cost effectiveness

To increase yield of major crops improving soil fertility determining the base of extension method for slurry utilization.

I compiled and assimilated the findings below which could be the farmer's voice of the rural areas of Bangladesh:-

- Collection of sufficient cattle lives for each farmer's family by arranging the supply involving the Govt. to provide subsidy as test basis for 10,000farmers which will be involved as buying power.
- Curb-down the mechanized agriculture gradually by promoting our renewable energy concept and method of cultivation.
- Regular supervision by the agricultural people through Govt. mercenaries like Ministry of Agriculture (DAE), Ministry of livestock and Fisheries to record their development for the purpose in collaboration with NGOs and other private sectors .
- Have the spirit of afforestation by the rural people during rainy reason to restore ecological balance which will curb down deforestation and their dependence on fire wood as well.

Line extension of the project (NDBMP) Phase II- 2013-2016

Picture as depicted by NDBMP Bangladesh focusing phase-II, year 2013-2016, in the rural areas of Bangladesh, 95% of people more or less are dependent on the conventional cooking system that is fuel wood and are harmful to the farmers' families while cooking in their respective kitchens. The average energy cost and time collecting these fuel woods put a substantial burden on the farmers families though their activities

Nutrients	Compost Manure		Farm-yard Manure		Digested Bio-slurry	
	Value Range in %	Average Value in %	Value Range in %	Average Value in %	Value Range in %	Average Value in %
Nitrogen	0.50-1.50	1.00	0.50-1.00	0.80	1.40-1.80	1.60
Phosphorus	0.40-0.80	0.60	0.50-0.80	0.70	1.10-2.00	1.55
Potassium	0.50-1.90	1.20	0.50-0.80	0.70	0.80-1.20	1.00

Table 2: Values of N, P, K in different types of organic fertiliser.

are mostly based on crop production and animal husbandry (live stock) in an instigated way, hence bio gas has a potential chance to provide them with less expensive fuel improving their livelihood. The objective of NDBMP and IDCOL is to promote development and disseminate domestic plant in rural areas with ultimate goal to develop and establish a sustainable and commercial biogas sector. The achievement up to 2012 as depicted, construction of 25000 domestic biogas plant and is running smoothly in all the Districts of Bangladesh and by the end of phase 1 it is expected to reach up to 32000 bio digesters. Also planning is going ahead for the establishment of a market based biogas sector in view of the 95% of the plants in operation. SNV – IDCOL has an ambitious marketing program for the bio digester users should they have at least 15kg (1-2 ha) animal manure from cattle or excreta of two hundreds small poultry birds required daily to feed a 2.4m³ biogas plant . This program provides flat rate subsidy of 108 US dollar. Providing the bio digester with tool for safeguarding quality plant construction and after sale service alongside a construction credit is offered from IDCOL along with KFW with credit interest of 6% per month on decaying principle within 2-3 year running time which is accepted mostly by clients. 80% of plants already constructed are being financed from this micro credit.

NDBMP enables the supply and demand of their clients under this program creating optional regulating commercial activity bio digester construction and credit provision and Non commercially. Global energy demand continues to surge and is set to double in the first half of this century, thanks to improved living standards and development in emerging economics. Many of the world’s remaining supplies of oil & gas are in harder – to – reach places such as under deep oceans or in the frozen Arctic (Shell, Oil).

Besides, the basic mission to increase food growing to optimum capacity could reach substantial increase thereto using bio slurry against all organic and inorganic fertilizers accruing much cost on the rural economy. In this context, I would like to mention that the concerned authorities already tried to adopt this biogas and bio slurry program in rural areas of Bangladesh but not properly ventilated till 2006 when SNV-IDCOL ventured forward to popularize the concept of biogas and bio slurry throughout the country to meet up the growing needs of gas and fertilizers friendly to our eco system already BARI has experimented this program for the last four years and reached a mile stone bringing its approval of BARC for bio fertilizer use. Data compiled by BAU, BARC, BARI and other ancillaries for fact findings and observations with a view to making the project a successful one considering the intensity of the situation about the crisis of energy ahead of us. Cruerical activity like training quality control promotion, monitoring and evaluation extension services, Carbon financing and policy development for biogas market promotion.

Out lining the phase II project 2013-2016 of NDBMP made

appreciable amount of progress in plant construction and institutional development is required to achieve creating a self sustaining market driven biogas sectors which require.

1. Financial autonomy
2. Create sufficient demand and supply
3. Multistate holder involvement for functioning programme and input of technical knowhow to stock holder

NDBMP has planed number of established 50,000 bio digester in phase II whose activities are confined

1. Prioritizing biogas sector
2. Boasting promotion activities
3. Ensuring a max return on investment by maximizing efficacy of bio slurry and gas use
4. Expanding the programme area to all district to find new digester
5. Working towards financial autonomy
6. Achieving marketing privatization after sale service control through fancrise system
7. Working towards decentralization of programme within id to build up local institutional ownership
8. The potential bio digester is 1 million approx with minimum feeling of 15 kg per day or less that 1 % of the rural house hold. A permanent commercially viable biogas sector 2016. Programme investment after 2016 will not include official development assistance rather comprise carbon revenue promotion

Research Activities under Soil Science Division

Laboratory analysis

The status of laboratory analysis of soil, plant and bio-manure samples is given in Table 3.

Findings: Table 4 shows Different no of Samples and different trail were made in 2008-2009.

BARI has conducted trails to determine the manural quality of bio slurry analyzing 28 and 60 samples in 2008and 2009 respectively. During 2008 application of manure contain cow dung (CD) and PM only, but in 2009 the application was further extended with Buffalo and mixed manure. Further, out of 12 sample of PM during 2008 lead content of 7 samples were below the safety margin compared to 3 samples of PM out of 14 samples during 2009 were below the safety margin .

Farmers opinion: The farmers who attended and experiment IPNS

Sample	Division		No. of samples		
			Targeted	Collected	Analyzed
Soil	Soil Science	Initial	04	03*	03
		Post harvest	36	36	36
	On Farm Division	Initial	111	78**	78
Plant	Soil Science		36	36	36
Manure	Soil Science		100	72	60
	On Farm Division		200	119	119

*In Kharif-I season on station experiment on Okra was not conducted

** In Kharif-II, T. Aman was grown in 7 different locations

Table 3: Status of laboratory analysis of soil, plant and bio-manure samples.

Sample	CD	PM	Buffaloes	Mixed	Year	Lead content
60	44	14	01	01	2009	3 samples <i>below safety margin</i>
28	16	12	x	x	2008	7 samples below safety margin

Table 4: Different no of Samples and different trail were made in 2008-2009.

with poultry slurry got better result, so farmer can use this new idea concept of bio slurry as a nutrient.

Bio-slurry project was started in the month of November which was one month delay from starting rabi season. As a result, some of the on farm trials were not conducted. So, the analyzed initial soil and manure sample were less than the planned number of samples.

On station experiment

Since the soil fertility of Bangladesh is decreasing every year at an alarming speed we must motivate the growers and farmers to use more organic fertilizers to improve the soil condition focusing all the advantages of its application. Besides, it is a global issue to contribute more to the soil than to extract from it for the conservation of nature and restoration of eco system, a dire responsibility for everyone on earth. Effect of bio-slurry on the yield and nutrient uptake of cabbage and cauliflower [1].

Cabbage and Cauliflower are the most important and popular vegetable crops in Gazipur sadar under AEZ 28. An experiment was conducted at BARI Central Farm to evaluate the performance of bio-slurry. The experiment was laid in RCB design with 3 replications. Six nutrient management packages viz. Inorganic fertilizer, IPNS with Cow dung, IPNS with Cow dung slurry, IPNS with poultry manure, IPNS with poultry manure slurry and native fertility were tested on cabbage and cauliflower. Different nutrient package significantly influence the yield and yield components of cabbage and cauliflower. Highest head yield of cabbage (98.3 t ha⁻¹) & curd yield of cauliflower (56.8 t ha⁻¹) were obtained from T₅ treatment (3 t PM slurry with IPNS base inorganic fertilizer) which was close to T₃ treatment (5 t CD slurry with IPNS base inorganic fertilizer). However, the treatment where poultry slurry was used showed higher yield and higher economic performance. Gross margin was higher where both organic & inorganic fertilizer were incorporated to soil compared to only inorganic fertilizer (T₁ treatment) while MBCR was higher in T₄ treatment (Table 4). MBCR was higher in aerobic decomposed CD/PM (T₂ & T₄) compared to aerobic decomposed slurry (T₃ & T₅) because per unit cost of slurry is 3-4 times higher than CD/PM. Fertilizer crisis is a burning issue across the country. Use of bio-slurry can play a vital role to minimize the fertilizer crisis. Moreover as organic manure bio-slurry may help soil fertility in the long run.

A. Evaluation of bio slurry and slurry compost a source of organic manure

It was observed that both anaerobically decomposed cow dung (CD), bio slurry and poultry manure bio slurry have higher nutrient value than aerobically decomposed cow dung and PM. Cobalt, nickel and cadmium concentration are minimal in bio slurry. It was also found manural value of bio slurry are higher in Rabi season compared to Kharif season and air dried bio slurry contains higher organic and nitrogen than sun dried bio slurry.

• **Findings are given:** Evaluation report speaks that anaerobically decomposed bio slurry has higher nutrient value than aerobically decomposed bio slurry that highlights the advantages of setting up many bio gas plants around Bangladesh giving many fold benefits of gas, power and bio manure.

B. Effect of bio slurry on the field and nutrient uptake of Cabbage and Cauliflower

It was observed that with the same quantity of nutrients used in 2009 the yield of Cabbage & Cauliflower was a bit higher (%) than that of 2008. About the quality of manures used T₅ which is 3 tons Poultry manure (PM) + IPNS based inorganic fertilizers is equivalent to T₃ which is 5 tons cow dung CD IPNS based fertilizers.

• **Findings are given:** BARI conducted research during 2008 about the effect of bio slurry on the field and nutrient uptake of Cabbage & Cauliflower. It was found through field experiments on cabbage & Cauliflower using different nutrient packages of which treatment with T₅ has given optimum yield which is a milestone for future application of fertilizers.

C. On farm trails

Effective of slurry as a source of organic manure on performance of different crops (2007- 2008) Field trials conducted at different locations (Panba Jessore, Rangpur, Tangail, Gazipur, Comilla, Bogra, Mymensingh and Faridpur) observing the effect of bio slurry on the performance of different crops during 2007-2008 using four nutrients management packages speaks in favour of bio slurry a byproduct of biogas plant should be the manure of choice compared to CD and PM (Tomato, Cabbage, Cauliflower potato, Maize, Boro Rice and Wheat). We must encourage the land owners to use more organic fertilizers (bio slurry) to bring back the nutrient contents of the soil at an acceptable level.

On-Farm Research and Development Activities under On-Farm Research Division BARI Reports (2008-2010)

On-farm trials on effect of bio-slurry on the performance of different crops

According to the Project Proposal, 2008-09 [1] one experiment 'Effect of bio-slurry on the performance of different crops' was scheduled to be conducted in 48 locations with 144 farmers throughout the country. The experiments were conducted with 5 vegetable crops (cabbage, cauliflower, brinjal, tomato and potato), 3 cereal crops (maize, wheat and Boro rice) and 1 oilseed crop (mustard) in Rabi season of 2008-09. The trial was carried out in Rabi season with 10 crops in 90 farmers field of 25 locations of the country. In Kharif I season 2009 the trial was carried out with 1 crop in 3 farmers field of one location. In Kharif II season 2009 the trial was carried out with T. Aman rice in 21 farmers' field of seven locations.

Findings are given below: A. On Farm research & Development:

A. On farm trails on effect of bio slurry on the performance of different crops: Trails were conducted in different districts of Bangladesh on different varieties of vegetable crops using inorganic fertilizers, IPNS with manure and IPNS with bio slurry of which IPNS with Bio slurry has given the highest yield irrespective of any crops. DAE can play a vital role to motivate the farmers and growers through demonstration and discussion, exchanging share of views of the superiority of IPNS + bio slurry combination for optimum production of crops with minimum expenditure favoring our eco system & improving the soil condition (nutrient value) which is decreasing at

an alarming speed every year. Moreover use organic fertilizers make a gradual shift towards nature

Over view of the observation and analysis by BARI's consultants on Cow dung (CD), Poultry manure (PM), PM slurry as prepared by expert. The Govt, and its ancillaries took many steps over the years and practically experimented the outcome of organic and inorganic manure for crop yield at the maximum level and found the following narrative ideas in various fields of agriculture in different locations of the country under supervision of Govt. NGOs, BAU, BARI and Grameen shakti. Henceforth my in depth study is described below categorically to have an eye view of the project.

B. On farm trials on effect of bio slurry on the performance of different crops (2009): Experiments were conducted with 5 vegetable crops (Cabbage, Cauliflower, brinja, Tomato and Potato) cereal crops and two oil seed mustard (Table 5). In 2008-2009 seasons the trial was carried out in 25 locations with 90 farmers in the country. 4 nutrient management packages viz. in organic fertilizer IPNS with poultry manure / cow dung / IPNS with poultry slurry / Cow dung slurry along with farmers doze were put under trial on different vegetables crops. Number of treatment slightly varied and absolute control present in some crops. BARI research report 2008-2010 can be seen [1]. BARI in their research report 2008-2010 experimented on Cabbage Cauliflower Tomato, Potato and Brinjal and found IPNS with bio slurry gave better result giving higher yield and less requirement of inorganic fertilizer.

- **Location Gazipur, Cabbage:** Several trails were conducted at the above location on cabbage growth, size and dimension, expert thereto reached a conclusion as to plant height, yield and weight per plant increased enormously in all sides viz. 0.23gm per plant using inorganic fertilizer like cow dung (CD), poultry manure (PM), and poultry manure (PM) slurry treatments. The yield from the poultry manure (PM) showed reasonable increase on the growth of cabbage and showed increasing percentage from 6.9 to 11 percent per plant. The treatment of the plant showed increasing of use of inorganic manure than the organic manure projecting a substantial increase in crop yield and it also showed maximum rise in growth using poultry manure in other locations also. The fact as assimilated for the cost price involved therein was bit higher than the conventional price of the fertilizer but on application eventually gained higher growth leading to economic gain. Treatment under taken with bio slurry than the organic fertilizer utilization is recorded it an earning good financial gain by the farmers compared to the earnings of the farmers practice previously.
- **Cauliflower:** Performance at Gazipur, TaingailPabna and Rangpur: Production of these crops showed very high yield ranging from 28 to 48 percent treatment using by bio slurry than

the inorganic fertilizer (though low cost) and farmers practice leading to higher economic growth in plant treatment on the field in various locations of the country.

- **Performance of Brinjal at Norshigdi, Shibpur:** Higher yield was recorded in the treatment of plant in field using organic fertilizer with bio slurry and the yield surprisingly extended up to (90 to 118%) over inorganic fertilizer and farmers practice, thus accorded good financial turnover per ha in cost return.
- **Performance of Maize, at Rangpur and Pabna:** The highest grain yield with IPNS+bio slurry combination was obtained by the farmers on trail in different locations leading to high output giving them high net income than the previous output.
- **Performance of Wheat at Jessore ,Rangpur and Faridpur:** The higher yield grain yield was found with IPNS+bio slurry treatment compared to inorganic fertilizers and farmers practice in all the locations showing more income than the previous years.
- **Performance Of Jute, (MLT):** The highest fiber yield with IPNS + bio slurry treatment was recorded at all locations giving maximum economic return with fewer requirements of inorganic fertilizers.
- **Pit and shade management:** There were 78 pits and shade management program in the plan, Out of 78 pit, shade management 60 number have been completed
- **Performance of Spinach (MLT):** Highest growth of Spinach on field using IPNS + bio slurry combination was recorded with the highest economic turnover compared to T1 & T3 treatments.

Farmers' field day on bio slurry: Different field day program where organized by related concern for dissemination and popularization by using bio slurring in place of organic fertilizers use by farmers but showed a negligible response from the farmers, it should be properly manipulated so that it reaches a penetrated point throughout the country otherwise the whole concept of promotion of bio slurry use could bring a little success.

Training for Capacity and Skill Development

According to Project Proposal, 2008-09, in the first phase of the project 4 batches of orientation training programs for scientific field staffs, 20 batches of cooperators farmers training and 23 batches of biogas users' training programs were scheduled throughout the country. The orientation training for field staff, 20 cooperators farmers training and 23 batches of bio-slurry users training were conducted during the phase I. Four (4) batches users and 2 batches SA/SSA/SAAO

	Potato	3	9	3	10	
	Wheat	2	6	3	11	
	Maize	2	6	2	9	
	Mustard	4	12	3	7	
	Rice (Boro)	11	33	6	18	
	Sub-total	-	35	29	91	
	Kharif I	Jute	2	6	1	3
	Sub-total	-	2	6	1	3
	Kharif II	Rice (T.aman)	11	33	7	21
	Sub-total	-	11	33	7	21
Total	-	-	48	144	37	115

Table 5: Effect of bio slurry on the performance of different crops (2009).

training were conducted during the phase II. The details of training are given in Table 6.

Following matters are required for the capacity build up

- **Base line cow dung (CD) position in Bangladesh:** Bangladesh a long history in bio gas extension program since 1972, which started experimenting under the auspices of Bangladesh Agricultural University Mymensingh, followed by BARD BSCIR on a pure primary Experimental basis.. A part of their research work and their adopted technology for the utilization of farmers showed a very poor picture up to 1984. Eventually putting the bio gas program in harness actually Govt. started this extension program in 1995 that continued by SNV which showed a ray of hope for its performance of the years and helped the rural farmers depending on the cattle live up to certain number which felt below the expectation giving rise to the cost analysis for consumptions and domestic level. Meanwhile, other NGOs showed their interest to participate in this ongoing programme like Grammenschakti and other POs and Govt.
- **Capacity development in Bangladesh:** The idea of bio gas extension program was taken by NDBMP under supervision of IDCOL: who tried to develop and disseminate in rural areas and set a target for accumulation which during last five years could not materialize to higher point of expectation than what was forecast before the inception and on the probable users all around the village in this country could not properly appreciate the ambitious program and fell much below the optimum point. The Extension program later on was modified as a Bio slurry program which the rural consumers also accept to its innovation, so to say the SNV- IDCOL was trying to encourage the Govt. Agricultural Program under DAE to train its extension worker for reasonable explanation and made exploration of bio slurry to the rural users
- **Present capacity position in Bangladesh:** Though the Pos are interest to build large number of plants in the country but they seldom have attainable targets yet program as ambition outlook confined training the masons and supervisors to meet the sustainable plant required may require additional financial subsidy to reach a higher target. IDCOL and others Pos have a strong finical support who are leaders in this rural areas can play a role in developing is present infrastructure level along side with other perspective NGOs under integrated policy environment . Local Govt. with good connectivity can play a vital role in future years. On the present perspective which may infuse a sense of sharing the new concept of bio gas program, which if

appreciatively adopted can reach a better consumption target in nest Twenty years.

- **Critical issues in capacity development in Bangladesh:** Beyond the modus–opera ding of SNV IDCOL after being stakeholder fail to reach a precise coordinated good because of miss information of data available to concern for which paucity their forecast on the program fell below the margin. he profit (accruable) from bio gas installation is low which incompatible with other resourceful program such as SHS ICS tense to higher income in this Program than the bio gas installation which has been rural users, more over switched over to other business sectors for their financial gain and survival.
- **Future capacity potential in Bangladesh:** The change of our of method imparting decision making training needs speed so that affective bottom to mid management staff could be given the best input to combat with the existing situation of the Agro based country and extend their service to people at large, and curve -down the cost management of each plant appreciatively so as to attract more people to buy it for their consumption. IDCOL’s interest for carbon offset finance for voluntary carbon offset market can be transfer in bio gas program to strengthen the hands of present bio gas innovative concept be lauder appreciatively by all and Sunday to generate and share with the Govt. and NGOs to share the intense energy crisis. In finale my observation remains purely on practical application than what projected in primary secondary and tertiary theories

Field Day on Bio Slurry Management and Utilization

To disseminate and popularize the effect of bio-slurry on crop production, there are 10 field day programs were scheduled to be conducted on-farm trial and demonstration sites of different locations. As per schedule all the field days have been organized in different locations across the country. In addition to that we have carried out another 30 field days on field crops, homestead and pit shade management of bio-slurry of phase I and II during the year of 2009. The total participants of the field days were 2800 (Table 7).

Present position and situation

- Biogas technology is slowly becoming popular in the rural areas of Bangladesh in view of escalating and unstable cost of fuel every now and then for cooking and other domestic purposes. International donors are coming forward extending their all out cooperation both financial and Technical with the participation of local people to make this project viable and alleviation of poverty and meet the energy crisis and thereby reducing the entry load in the developing country like Bangladesh. Various

»Type of Training	Number of Training	Locations	Number of participation
» SA/SSA/SAAO » training	o 6	o 4	212
» Coperators training	o 20	o 20	600
» Bio-slurry users training	o 27	o 27	810

Table 6: Training for capacity and skill development.

Activity	Season	Number of field days	No. of participants	Locations
Field day	Rabi	36	2520	Bogra, Kushtia, Tangail, Pabna, Rangpur, Barind, Shampur, Jessore, Faridpur, Khulna, Patuakhali, Barishal, Noakhali, Comilla, Mymensingh, Kishorganj, Jamalpur, Sylhet, Narsingdi, Gazipur
	Kharif II	4	280	Pabna, Bogra, Rangpur, Noakhali

Table 7: Field day on Bio slurry management and utilization.

project have been under taken by different NGO's and other organizations to help promote bio gas technology to every nook and corner of the rural Bangladesh, in spite of hardest challenge in restoring a forestation which is deforested every day by the people for their cooking device which is a very unhealthy sign for growing economic balance in the country. So we should try to encourage the rural people to curb down their dependence on fire woods for cooking and instead adoption of our ideas can play a very vital role amidst international energy crisis prevailing all over the world.

- Global energy demand continues to surge and is set to double in the first half of this century, thanks to improved living standards and development in emerging economics. Many of the world's remaining supplies of oil & gas are in harder-to-reach places such as under deep oceans or in the frozen Arctic. (Shell Oil).
- Besides, the basic mission to increase food growing to optimum capacity could reach substantial increase thereto using bio

slurry against all organic and inorganic fertilizers accruing much cost on the rural economy. In this context, I would like to mention that the concerned authorities already tried to adopt this biogas and bio slurry program in rural areas of Bangladesh but not properly ventilated till 2006 when SNV –IDCOL ventured forward to popularize the concept of biogas and bio slurry throughout the country to meet up the growing needs of gas and fertilizers friendly to our eco system already BARI has experimented this program for the last four years and reached a mile stone bringing its approval of BARC for bio fertilizer use. Data compiled by BAU, BARC, BARI and other ancillaries for fact findings and observations with a view to making the project a successful one considering the intensity of the situation about the crisis of energy ahead of us.

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