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Local knowledge about vegetable crop biodiversity in Sub-Himalayan North Bengal

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Short Abstract: In this paper, local knowledge of peasants of Sub-Himalayan North Bengal (India) regarding vegetable crop-biodiversities will be illustrated with suitable examples.

Long Abstract: In this paper, local knowledge of peasants of Sub-Himalayan North Bengal (India) regarding vegetable crop-biodiversities will be illustrated with suitable examples. Local crops and crop diversities are going to be enlisted here elaborately. These local strains and wild varieties enrich the genetic pool in the local ecosystems. Local peasants though prefer improved varieties and hybrids, but they also conserve the traditional/ local varieties as well. They do not rule out organic manure application.

Main Article

Cultivation process of local in Sub-Himalayan North Bengal has changed with time. But how? I shall discuss it point wise.

Facts	Impacts
A century ago tribal people in the Sub-Himalayas used to practice slash-and-burn technique (information taken from Mechi Mahananda basin).	That is usually known as *Jhum* cultivation (*Jhum chas*).
Now, the question is whether Rajbanshis followed the same process.	Local Rajbanshis deny of any such practice.
I have seen forest burning rather in hilly slops where no Rajbanshis reside in.	Nepali speaking people are basically living there. Previously, Limbu people stayed there who have now been included within the Gorkha.

Adivasis from Central India and Chhotonagpur were brought into the region and they were deployed in clearing up of the jungle.	Tea estates have been established there. Settled agricultural practices have been initiated. Alternative economy spreads rapidly. Tribal peoples like Dhimal and Tharu show decline in number.
Rajbanshis used to fallow their land in off-season and perform seasonal agriculture.	This helps in regaining fertility of the soil. Traces of bush fallow cultivation and then burning out of the bushes (such as of *bhant* bush during fall/winter/autumn) could be observed. Various woody bushes are used as good quality fuel (cost-efficient).
Rajbanshis used to maintain cattle and graze them in their fallow and waste lands.	Cow milk is used in production of card. Cow dung is source of both fuel and fertilizer.
They raised kitchen garden in upland near their homestead and propagate different types of vegetables and some spices.	Both summer and winter vegetables are being cultivated. Growing market for vegetables and spices help in poverty eradication. Brinjal, gourd and other cucurbits, pumpkin, cabbage, cauliflower, tomato and many such vegetables are very common. Inter cropping, mixed cropping, crop rotation, ally cropping, legume plantation, small tea gardens, floriculture (marigold, etc.), fruit plants (jackfruit, mango, etc.), green house made up of plastic sheets, shades, fencing, lattice and traditional agricultural implements are important characteristics. These things with or without proper irrigation and drainage facilities are directly connected to issues like crop failure, soil fertility and yield. Various leafy vegetables are locally known as *shak* and some of them have medicinal importance. Many grow up naturally and reluctantly like weeds. Surpluses are sold in market and it compensates some of the total expenditure in vegetable cultivation. This is a kind of cost-efficient service.
Lowlands are generally used for paddy, jute, mustard and pulses.	Lowlands are suitable for fish-cum-paddy cultivation. Jute is fiber yielding crop of summer-monsoon season. Jute is harvested on 110-120 days after sowing. Their tip portions are pruned and further propagated in muddy ditches. There are some drought resistant summer varieties (*aus*) and some flood resistant marshland varieties (*joli*) of paddy. *Aus* paddy crops have been replaced by vegetables and maize. Similarly, areas where *joli* varieties were usually cultivated are now subjected to jute production. Basically, winter and monsoon paddy are being cultivated and these are known as *boro* and *amon* respectively. Many high yielding varieties (HYV) are also being introduced. Mustard and pulses are crops of dry season and need

	irrigation. *Maskalai*, *thakurkalai* and *mung* are different pulses. *Tisi*, *teel* and sunflower can produce edible oil like mustard.
Village is generally provided with some water bodies (ponds, local streams, etc.).	These are often used for perennial fishing. Crabs and shrimps are available in local streams besides small-size exotic fish varieties (*nadiali machh*). Ethnotoxic substances are traditionally used that put their effect on *nadiali machh* but not on certain mosquito-larvae-eating fish species (non-edible). Varieties of frogs and some snakes (both venomous and non-venomous) are also found, however Rajbanshis do not catch frogs and snakes. I was informed that leg muscles of frog and snake venom have some medicinal importance. Pisciculture now involves with ornamental fishes. Turtles and snails used to be eaten at a time. However, I could not find much information on this. Crocodile and river dolphins were once found in rivers of North Bengal (now extinct). I do not get any information on snake skin, turtle shells or crocodile skin. However, snail shells are often considered as raw materials for indigenous lime production. Various traditional fishing implements are still being used. Arums of various types are known to be propagated. Water weeds, water grass, water hyacinth, water lily, trapha, ferns, aquatic plants and lotus are some important hydrophytes. Duck, crane, migratory birds, cat fishes, eel and various water bugs are different aquatic fauna. Water is often covered by red or green algal colonies like the layer. These increase micronutrients to the ecosystem.
Villages are covered by greenery.	Bamboo, cane, palm, wild grasses; date, catechu, thorns; ageal, zambura, mango, jackfruit, tamarind, guava, ata, nona, chalta, dumur, kamranga, papaya, plum, lichhi, coconut tree, areca nut, banana; turmeric, ginger; radish, different potato, knolkhol, arum; maize, wild millets; gandal, jackfruit, cow pea; azadirechta, *jiga*, banyan, ferns, betel vein, medicinal plants (*gandal*, *thankuni*/*manboni*, *vasak*, *neem*, *chirata*, etc.); shorea, rubber and teak are among the common greenery in and around the village upland sloping down into the lowlands. Many of these have multipurpose usage, served as alternative food sources (fruit, spices and subterranean products), fodder, ethno-medicines and utilized commercially.
Organic manure is used widely.	Vermi compost is the best example that is applied with cow dung manure in a given ratio to a typical cropping system. Organic waste material, paddy straw, coconut and areca leaves, dry leaves, ash pile, egg shell, boiled tea leaves, rotten tobacco, mustard cake, neem cake, mahua cake, compost of

	water hyacinth and good quality soil are raw materials of organic manure. Neem oil and ash are good for pest control.

Process of *slash and burn* cultivation:

Facts	Indigenous Knowledge
Beginning of the process at late winter	1. North Bengal Sub-Himalayan forest region is mixed deciduous by nature 2. Soil is covered with dry leaves that could be burnt off easily 3. Winter season is basically dry and moisture is minimum 4. From late winter to autumn,
Selection of an area	1. Semi nomadic people with their cattle shift to the area nearby and settle their hearth 2. They use bamboo (along with teak and shorea wood) for the purpose of construction 3. They have preserved food and grains with them in stock (previous agricultural practice ended up with harvesting and post-harvesting practices; latter include food preservation)
Slashing out of bushes and trees of that area	These cut off portions would eventually into compost manure and increase soil fertility
Residues are let to be rotten	1. Mild raining in late winter and autumn 2. Microbial activities initiate 3. Decomposition process adds organic matter and various micro-nutrients into the soil
Burning off of the dried residues (top cover)	1. Heat makes the rotting materials (lower level) into compost 2. Ash layer acts as anti-microbial agent 3. Thunderstorm (pre-monsoon raining) at early summer, dry late summer and high moisture level throughout summer are three pre-conditions for increase in pest activities from neighbouring forests and soil; but ash layer prevents such harms 4. Thunderstorms and pre-monsoon rains increase soil moisture
Spreading or sowing of seeds	1. Clear sky, pleasant sunshine and ash layer defend pests and microbial attacks on the seeds 2. Moisture in the air helps in seed fertilization 3. Moisture level in the atmosphere is good as the

	selected area is surrounded by forest greenery 4. Some shade trees are there in the selected area that provide necessary shadow to protect the seedlings from hot sunbeams 5. Seedlings grow into saplings and then into plants 6. Generally upland varieties of staple crops are cultivated in this way
Monsoon rains reaching into Himalayas and Sub-Himalayas	1. Quick growth in staple food plants 2. Harvesting, thrashing and stock raising continued upto spring and fall 3. Weeding is there; however, weeds shade the naked land and their dried residues add further nutrient to the soil
Fallowing	1. Selected area is good for three or some more crop cycles 2. After that the land in let to be fallowed for short term or long term (ten years) to regain its nourishment 3. Sometimes, jungles redevelop there 4. People shifted to another area and perform the same process 5. Fallowed land could also be used for the purpose of grazing 6. Short term fallowing destroys pests and pathogens due to the lacking of host plants 7. Upland drought resistant staple crops are generally chosen (various millets, pulses, maize, summer paddy/*aus*) 8. This is accompanied with cultivation of vegetables 9. The entire process stands for subsistence 10. If there is crop failure, people eat wild food (mushroom, ferns and fruits) 11. This could be followed by monsoon paddy/ *amon* and even winter paddy/ *boro* (with vegetables and rapeseeds) 12. Irrigation for winter crops is essential. 13. In this way, multiple cropping in a crop year begins. 14. Cropping becomes permanent associated with crop rotation, inter cropping and mixed cropping. 15. Fallowed time span is reduced.
○ Rajbanshis are caste people and they practice permanent cultivation with crop rotation, inter cropping and mixed cropping. However, they fallow their land and often use it for grazing. ○ They cultivate vegetables at upland (autumn-summer, monsoon-spring, fall-winter). ○ They maintain their bamboo grooves and fruit plants there. ○ They conduct water management and introduce irrigation. ○ They cultivate jute for fibers.	

- They yield monsoon and winter paddy along with some winter crops like vegetables, potato and rapeseeds.
- Monsoon and winter paddies provide surplus.
- Summer paddy varieties (upland and drought resistant strains) become less important.
- Dependence on wild foods decreases to a considerable level.

Common agricultural products in Barind and Mahananda basin (Sub-Himalayan North Bengal)-

1. Paddy (amon and boro), makio, wheat, jute, sugarcane, gourd, pumpkin, squash, cabbage, cauliflower, spinach, lafa, amaranth (danta), dhenki, sop, bethu/bathua, tomato, bean, potato, ginger, turmeric, arum, knolkhol, elephant foot yam, betel vein, cucumber, papaya, kakrol, animal fodder
2. mustard (sada sorisha and rai), sunflower
3. Kalai (kala dal/ thakur kalai, mask alai), mung, musur, gai mung
4. palwal, luffa, brinjal, bhindi/dheros, chichinga, dhundhul
5. morich/ chili, coriander, bay leaf and other spices (clove, cumin, cardamom, etc.)
6. banana, mango, jackfruit, litchi, tamarind, citrus, kamranga, zambura, dalim, nona, ata, chalta, dumur (fig), guava, areca nut, plum, palm, jam/jamun/black beery, pineapple, date, thorny plants, amlaki, bohera, neem, ageal, catechu
7. bamboo, cane, tea, rubber, mulberry, jiga, shorea, catechu, etc.

Common agricultural products in Jalpaiguri and Cooch Behar agricultural plains (Sub-Himalayan North Bengal)-

1. Paddy (aus, amon and boro), makio, wheat, marua, sugarcane, animal fodder
2. jute (tosa and sona), hemp, cassia, tobacco
3. radish, beet, carrot, cabbage, cauliflower, potato (big and small size, sada, badami, lal and lal-golap; spiny and air potato (kupri or chupri), indur alu, kham alu, misti alu/ ranga alu/ yam, keshar alu/ shakalu, various gourd (sweet gourd, snake gourd, bitter gourd, kakrol, etc.), tomato, cucumber, pumpkin, peyanjkali/ spring onion, papaya, bean, shim, barbati
4. kalai (kala dal/ thakur kalai, mask alai), musur, mung, gai mung
5. palwal, luffa, brinjal, bhindi/lady's finger, chichinga, dhundhul, sajina
6. banana, elephant foot yam, arum (mann and mukhi), garlic, onion, ginger, turmeric

7. mustard/sada sarisha, rai, sesame, lafa, dhemsi, amaranth/note, spiny amaranth/ kanta note/khuria kanta, danta, lalshak, spinach/palang, puin/ kachapata, betel vein/pan, bathua, curry leaf/ karipata, coriander/dhania, brahmi, dhekisak, kundri, takpata/amrul
8. dandakalas, kansisa, thankuni, gandal, basak, etc.
9. radhuni/aduni, poppy/posto, cardamom, cumin, clove, morich/chili
10. date, date palm, plum/ buguri, litchi, sugar cane, mango, black berry, jackfruit, guava, tamarind, amlaki, zambura, golapjam, dalim, nona, ata, chalta, dumur (fig), jalpai (olive), citrus, orange, mosambi, pine apple (low quality), ageal, neem, ghora neem, catechu, kamranga, coconut, areca nut, lotka
11. bamboo, cane, tea, rubber, mulberry, erenda, teak, aikhanjan, jhapsa/jhigni, auri, korai, akanda, bijalghanta

Common vegetable crops propagated by the local peasants are mentioned below-

Winter- Potato, yam (kham alu, penti alu, metey alu, kanta alu, bon alu, maj alu), chikri or chikni alu, sweet potato (ranga alu or misti alu), keshar alu, shakalu (yam bean), peyanj (onion), peyanjkali (spring onion), rasun (garlic), shalgom (turpin), cassava, radish, carrot, beet, ada (ginger), halud (turmeric), cauliflower, cabbage, broccoli, natishak or china kopi, olkopi (kohlrabi), jhar shim (French bean), shim, barbaty, motorshuti (pea), gaimung (cowpea), soybean, black gram (kalai), masur/ lentil, mustard, tisi (common flax or linseed), til (sesame), bua marich, tomato, cucumber, shitlau (giant carandilla), lau (pumpkin or bottle gourd), pani kumra (wax gourd), misti kumra (sweet gourd), lemon (pati lebu and kagji lebu), zambura, pepey, potol (palwal), sop/sholuk, lafa, danta, lalshak, notey, kanta notey, natoan, puin or kachapata, palang (spinach), tak palang, bothua, dhemsi, pudina (mint), dhania (coriander), rai shak, sorshey shak (mustard green), lettuce, kundri, nunia, bhant, chamghash, kauni, bhutta/makoi, marua, pan (betel vein)

Winter to monsoon- Brinjal, water melon, echad, jute leaf, tarmuj or kharimunja

Monsoon- Borshali morich, potol (palwal), kanchakala, pepey, sajina, jhinga/toroi/satpudi (luffa), squash, sweet gourd, chichinga, dheros or vindi (okra or lady's finger), lau (pumpkin or bottle gourd), gera or dhundhul, dudhkushi or chichinga, uchhe and karala, kakrol, telakucha, ol,

kachu, poltapata, kalkeshut, gulancha, amrul/takpata, oshni/sushni, kolmi, gima/gima kolmi, brahmi, kulekhara, shaluk, helencha/ hinche, sachi/ sache, thankuni, jalsingara, mushroom, bamboo young shoot

Common fruit plants → supari or gua, kul or buguri, khejur, narikel or dab, lichu or leusi, ankh, khajur, sofeda, pepe, anaras, aam, jam, kalojam, jamrul, kathal, tentul or tentuli, amlaki (aonla), zambura, golapjam, dalim, dumur or khoksa, amra, ata, nona ata, yagyan dumur, chalta, mosambi, kamala or komla, ghora nim, lebu or nebu, bel, kadbel, kamranga, peyara, bilati kesar/ kesar alu,, jalpai, gab, tarmuj (khorimunja), kola or kela or kera, lotka/notka, pindari

Spice → tejpata, holud, ada, peyanj, rasun, golmorich, radhuni, elach and daruchini

Jangli longg found in paddy field

Some other plants→ aikhanjan, jhigni, pauri, korai, odol, akanda, gamari, ghoraneem, segun, kadam, kathgua, chorka, horitoki, shefali, yagyadumur, sthalapaddda

Banana varieties- manua, atia, chinichampa/ champa, deshi bhog or malbhog, jahaji kela or asami kela or kanchakala

Arum varieties-

1. mukhikochu/ sujikochu
2. panikochu
3. mann kochu
    a. bhog kochu
    b. sadharan kochu

4. kalo kochu
    a. alanji kochu/ kalanji kochu
    b. dudh kochu

Jute-

1. meshta pat- small fiber
2. tosa pat- long fiber
3. deshi pat or teto pat- leafy vegetable

Chili variety-

1. bhutua
2. kangra
3. dhanua
4. akashi
5. siti

Bitter gourd variety-

1. Uchhe
2. Karala

Cucumber variety-

1. Mico
2. Deshi
    a. Shosha
    b. Khira

Alu / potato varieties-

1. Sada alu- gol and lamba varieties
2. Badam or badami alu
3. Lal alu- gol and lamba varieties
4. Lal golap alu
5. Misti alu or ranga alu
6. Chikni alu
7. Indur alu
8. Kupri alu or chupri alu
9. Penti alu
10. Kham alu or maj alu
11. Endur alu
12. Shak alu or keshar alu
13. Punjab variety

Potato with buds or eyes → 6/4/5

Buds or eyes selected→ 3

Radish varieties-

1. Sada
2. Lal
3. Bombai

Shim (bean) varieties-

1. Kalo
2. Lal
3. Lomba
4. Deshi or gengradim

a. Sada
b. Sabuj

Lafa (local leafy vegetable)-

1. Chhoto lafa
2. Boro lafa

Palwal or potol- 1) monsoon to fall, 2) summer to monsoon

Local variety- najirhat potol

Potol

1. Early variety
2. Late variety preferably cultivated on *mancha* or bamboo lattice

Maize-

1. Winter variety
2. Summer variety

Mustard-

1. Sorisa
2. Sada sorisa
3. Rai

Coriander-

1. Local dhania
2. Hybrid dhania

Bamboo-

1. Kokoa
2. Makla/ muli
3. Borobans
4. Nol
5. Jhar
6. Soti

Sugar cane-

1. Yellow-green
2. Blackish red

Luffa or ribbed gourd-

1. Toroi
2. Jhinga
3. Satpudi

Tobacco-

1. Golpata
2. Bihari
    a. Motihari
    b. Godhra
    c. Khaini
3. Tongua
4. Velengi
5. Virgin

Citrus-

1. Mausambi
2. Kamla
3. Zambura/ batabi
4. Lemon
    a. Gol lebu
    b. Elachi lebu / kagji lebu

Cropping pattern side by side-

1. Potato-radish
2. Potato-dhemsi
3. Potato-bothua
4. Potato-sweet gourd
5. Potato-mustard
6. Potato-mustard- dhemsi
7. Potato-spinach-dhemsi
8. Potato-late palwal
9. Palwal-mustard
10. Palwal-mustard-lemon
11. Palwal-radish
12. Palwal-chili
13. Palwal-luffa-chili (late autumn to early spring: best production in summer and monsoon)
14. Palwal- okra- bottle gourd-cucumber
15. Okra-chili
16. Satpudi (local variety of luffa) - dudhkushi (local variety of snake gourd) - okra
17. Luffa- bitter gourd
18. Luffa-turmeric
19. Leafy vegetable-brinjal

20. Cabbage-brinjal
21. Cabbage-dhemsi
22. Cabbage-radish
23. Spinach-lafa
24. Spinach-mustard
25. Squash- karala (bitter gourd)
26. Turmeric-ginger
27. Turmeric-ginger-elephant big foot
28. Radish-lalshak
29. Radish-danta/notey/amaranth
30. Radish-dhemsi-lafa
31. Tomato-dhemsi
32. Cucumber-mustard
33. Cucumber-garlic-onion
34. Lafa-danta
35. Lafa-lalshak
36. Litchi-kamranga
37. Jalpai-amlaki
38. Coconut-betel nut-papaya
39. Potato-boro paddy-wheat-shitlau-rotten muddy floor of drying pond (sloping landscape)
40. Banana-turmeric-ginger
41. Yam/cassava-arum
42. Paddy-bamboo-water grass (fodder)
43. Manboni-surjasisir-chamghas

Mixed cropping-

1. Potato+bothua
2. Potato+dhemsi
3. Potato+bothua+dhemsi

4. Lafa+sop
5. Radish+palwal
6. Radish+lafa
7. Radish+dhemsi
8. Shim+bottle gourd
9. Mustard+cucumber+ the system could be surrounded by turmeric
10. Amon paddy+kalai pulses (khesari or thakur)
11. Mustard+masur pulses
12. Spinach+coriander
13. Sweet gourd+bitter gourd
14. Cabbage and cauliflower nursery + dhemsi

Crop sequence

1. Radish → early palwal → chili
2. Early palwal→ monsoon palwal
3. Shitlau → jhinga (luffa or ribbed gourd)
4. Birili morich (winter chili) → barshali chili (monsoon chili)
5. Potato → jute
6. Potato→ chili/ okra/ ribbed gourd/snake gourd/ bitter gourd/ sweet gourd/ palwal/ cucumber
7. Cabbage and brinjal → arum
8. Tobacco→ onion → sweet gourd
9. Amon paddy → mustard and potato→ jute
10. Amon paddy→ boro paddy and wheat → jute
11. Amon paddy → winter maize → jute/ summer maize
12. Amon paddy → winter vegetables/ potato/ mustard → jute
13. Amon paddy and kalai pulses → vegetable, pea, mustard, rai, tisi, til, masur and other pulses
14. Amon paddy-kalai pulses (khesari or thakur)→ Kalai pulses-mustard → Mustard-masur pulses

15. Amon paddy → Sunflower/ potato
16. Amon paddy → ground nut
17. Amon paddy → mustard/ boro paddy → amon paddy
18. Bean/shim→ okra/luffa/bitter gourd

Amon paddy seeds → seed bed (*bichon*) → sapling bed (*balan* or *bolan*) → main crop land (*patan*) → 1) Hybrid varieties- 1.5 hand by 1.5 hand distance/ 2 plants in each guchhi; 2) local varieties- 1 by 1 hand distance/ 3 plants in guchhi; 3) boro hybrid- 1.5 hand by 1.5 hand distance/ 3, 3-4, 4-5 plants in each guchhi; land preparation, weeding, manuring and pest control are different stages; harvesting and post-harvesting practices often associated with cultural performances → additional side growth (*polan*) could be expected after harvest being completed

Organic manure

Local people preferred the earth warm, white ant and even ants as agriculture friendly organisms (obviously when under control). Earth warms do the same thing a plough does in order to prepare the land. White ants decompose the dead and other unnecessary organic compounds that help in sustenance of the bio-geo cycles. Ants also help in decomposition as well as allow air to enter within the soil through the channels they produce for their easy passage. They eat up the dead organisms, cut off the leaves into pieces, pollinate the flower, consume a decaying fruit, and construct underground chambers to live where air can pass into. Ants through their activities could make a weather forecasting; such as, their accumulation beneath the tree leaves or within the tree trunks indicates that the rain is coming. But now the ants are often found to fail from making a correct forecast. They have failed to adjust themselves with the rapid changes in weather and often denote wrong weather forecasting. Again, excess presence of ants, white ants and earth warm again reduces the fertility of the soil.

Cow dung is the best organic manure to the local cultivators. Local people do not apply cow dung in the field directly, but actually in dried powdery condition. They also know how to make a compost of it. They take the cow dung along with paddy straw in pile and cover it with plastic sheet. Dung and urine of goat are also good fertilizers in small amount that the local people and other local people apply in horticulture. In a dig, they store vegetable superfluity, some cow dung, paddy straw and ash layer by layer for one to two months and over the chamber under paddy straw sheet. This also gives them manure. They sometimes apply this manure with water of margosa and/or mustard cake. They use the manure in nursery or different times in the main cropland (before sowing, during sowing, after sowing). Various weeds from courtyard, kitchen garden, jungle and water bodies are collected and dried and applied with this manure. During preparation of the manure, they sprinkle water and cattle urine on the system. They generally produce this manure in their kitchen garden. They soil is very fertile there and often lattice is build up there where they plant creeping vegetables that again provide shade to this manure production unit. For each crop, stone free and germ free manure, water, bone dust, boiled tea leaves, egg shells, cow dung or rotten leaves, micronutrients and NPK could be added in prescribed amount.

So, cow dung, half rotten and full rotten leaf manure, ash, nitrogenous soil, soil collected from the ground where the jungle was destroyed on fire, boiled tea leaves, rice emulsion, superfluity, rice dust, seed coat, cow urine, bone dust, egg shells, snail shells, remains of small fish-crab-prawn and even paste of rotten remains of mastered or other rapeseeds (after extracting the oil) are basically used as the organic manure. The collected cow dung from field is kept inside bamboo funnels and heated before applying as manure.

In case of vegetable cultivation in upland areas (*danga*), more or less 100 Kg of cow dung is used along with *Tricodarma viridi*, pseudomonas microorganisms, and fluorescence microorganisms per *bigha*[i] land. This could vary from five to ten vans of cow dung. This equals to 250-500 gm sea weeds that could be used as powder in water emulsion and liquid form. But this is not a usual practice of the common local people. Often cow dung manure is applied in part by part to the cropland. This process is known as *Chapan*. Quality of dung manure depends on the fodder. However, in these days various other manures are being added to the cultivation ground. In green house for vegetables and flower plants, again cow dung and microorganisms with different cakes, NPK, vermicompost, azolla and other water weeds, and even lime are added to produce the crops and flowers on regular basis.

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i In West Bengal, the *Bigha* was standardized under British colonial rule at 1600 sq.yd (0.1338 hectare or 0.3306 acre); this is often interpreted as being 1/3 acre (it is precisely 40⁄121 acre). In Metric units, a *Bigha* is hence 1333.33 m^2.