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Review

Practices of Indigenous Agriculture Knowledge of Farmers in India

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Abstract

The traditional Agriculture Knowledge is epic information, was created by the forefathers in the past civilizations. The forefathers practiced traditional agriculture information during Harappa civilizations, Vedic and Iron Age civilizations. The present Small and Marginal farmer utilizes traditional information in the crop production & management, crop protection, farm machinery & tools, soil & water management, medicinal & aromatic plants for diseases diagnosis, animal husbandry, stored grain pests' management, weed management and value added food product and transfers in the youth. The utilizing traditional informations in the agriculture practices are collected from the different geographical states of India. The informations are practiced in the specific activities by the farmers. The farmer utilizes compositions of natural resource in the geographical states for the crop husbandry and farm linked activities. The traditional information is more practiced by the Southern and North-Eastern Geographical zone. The farmer applies specific informations in the crop production & management, crop protection, farm machinery & tools, soil & water management, medicinal & aromatic plants for diseases diagnosis, animal husbandry, stored grain pests' management, weed management and value added food product. The farmer preserves and transfers the information in the rural community. The farmer transmits information in the present generation for creating mobilization. The traditional agriculture information transforms agriculture resources, maintains biodiversity ethics and enlightens historical and practical approaches to the present generations.

Keywords: Practices; traditional knowledge; agriculture; farmers; India

Novelty

Practices of tradional information in the farmer's community,
Awareness of the tradioinal informations in the youth community,
Conservation and Application of tradional informations,
Maintainance of ethics of the natural systems.

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1. Introduction

The collection and utilization of forefather agriculture informations from the areas of crop production, plant protection, animal husbandry, farm machine & tools, stored grains pest management, rituals in agriculture, value added product preparations for agriculture activities in the present period are called traditional knowledge of agriculture. The land preparations, cropping systems, cropping pattern and preservation of grains were emerged in the Harappa civilizations. The rotation of crops, processing of crops and preservation were initiated in the Vedic and Iron age civilizations. The jum cultivation and kumari cultivation are originated in Aryavarta period in 11 century AD. The south Indian farmers cultivated rice in jum cultivation and kumari cultivation. The local paddy variety is known as Sali was cultivated in the Aristobalus period in 320 BC. The transplantation of seedlings in highland and lowland around volume of water was initiated in Aristobalus period. The traditional knowledge emerged and utilized in the ancient India. The traditional knowledge uses in the economic development and policy development **(Fig. 1).**

The large and small scale industry applies traditional agriculture knowledge for producing commodities without IPRs policy. The government of India ameneded IPRs policy for using traditional knowledge of agriculture **(Sofia and Deepa, 2020**). The traditional knowledge enlightens and transfers the agriculture education and research was advanced the agriculture technology in India; transformed sustainable agriculture into modern into smart agriculture. The small and marginal farmers involve more in agriculture occupation, counters high cost of the agriculture technology in smart agriculture. The Indian farmers are completed to identify the modern technology of agriculture in Digital India but the small and marginal farmers are unable to purchase modern technology for agriculture activity because of the low land area, less per capita income and less support of the government scheme. The farmers follows traditional knowledge of agriculture for the crop production, farm linked activities and management. The farmer utilizes conventional knowledge in crop production, soil & water management, pest & disease management, animal husbandry and farm machine & tools **(Aunpam *et al*., 2020) (Fig. 2).** The traditional knowledge in agriculture was originated from the various cultures and community of the farmers. The farmer utilizes ancient agriculture informations for reducing the cost of cultivations and maintaining natural selected agriculture **(Ajay Singh Rajput, 2018).** The traditional knowledge of agriculture is available in the form of myths, lyrics, quotes, dances, cultural age & taxonomy, cultural materials and species. The goals of traditional knowledge are to restrict overexploitation of natural resources and restore long term natural resources **(Kareemulla and Ravichandran, 2020).** The traditional knowledge has affordable and low risk for farmer practices. With this background, The following objectives were investigated in the research ie.,

1.1) Indigenous knowledge Practices of farmers in crop production and management,

1.2) Indigenous knowledge Practices of farmers in plant protection,

1.3) Indigenous knowledge Practices of farmers in farm machine & tools,

1.4) Indigenous knowledge Practices of farmers in soil and water management,

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1.5) Indigenous knowledge Practices of farmers in medicinal & aromatic plants for disease diagnosis,

1.6) Indigenous knowledge Practices of farmers in animal husbandry,

1.7) Indigenous knowledge Practices of farmers in stored grain pests' management,

1.8) Indigenous knowledge Practices of farmers in weed management,

1.9) Indigenous knowledge Practices of farmers in food product.

The conventional knowledge of crop production and management, plant protection, farm machine & tools, soil and water management, medicinal & aromatic plants for disease diagnosis, animal husbandry, stored grain pests management, weed management and value added product preparation were collected from different geographical states in India. The ancient informations of crop production, crop management, crop protection, farm machine & tools, soil and water management, medicinal & aromatic plants for diagnosis diseases, animal husbandry, stored grain pests management, weed management and value added product preparation are presently utilized by the farmers for crop production and farm activities.

1.1 Indigenous knowledge Practices of farmers in crop production and management

The Himachal Pradesh farmers is utilized grafted mango pit, is dugged out 3×3×3 feet, 25 feet apart on either side. The pit is dried in the presence of sunlight for 3 months. The community of weeds, pests, and insects are declined in the pit. The burned leaves and twigs are buried near to the mango tree in the early morning and late evening, promotes flowering and mitigates hopper populations (**Kranthi *et al*., 2016**). The Tamil Nadu and North eastern farmer practices sunflower cultivation in between mango trees that attract honey bees and raises pollination and fruit production **(Das *et al*., 2019)**. In the solar eclipse day, 3-5 feet bark of the mango tree is excised out from the ground. The flower is not emerged in the mango tree. The Andhra Pradesh farmer is covered mango fruit with paddy straw in the room is closed for a week for uniform ripening of the mango fruit **(Mangla, 2009).**

The Manipur Farmer uses Pit Nursery Method for crop seedlings in the pit. The pit maintains water requirement and forbids evapo-transpiration loss (Ansari *et al*., 2021). The Jharkhand Farmer uses *Paira* cropping system in rice lowlands and broadcasted *Lathyrus* seeds in the main field of rice for water management (Dey and Sarkar, 2011). The Farmers of Western Ghat zone of Maharashtra cultivates Indigenous rice Tulshi tall and the Farmer of Konkan region of Maharashtra cultivates Indigenous rice Vikram for mitigating type II for mitigating diabetes, obesity, and cardiovascular diseases. The farmer of northern district of West Bengal Farmer grows Tulaipanji traditional aromatic rice variety for aroma seed quality. The farmer of Kullu valley of Himachal Pradesh grows traditional aromatic rice cultivar Jatu rice for aroma and taste. The Himachal Pradesh farmer cultivates Matali and Lal Dhan local rice cultivars for diagnosing fever and reducing blood pressure. The hills of Himachal Pradesh and Uttar Pradesh Farmers grow traditional red rice variety Kafalya for curing leucorrhoea and complicated abortion. The Tamil

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Nadu Farmer cultivated traditional rice cultivar Kari Kagga and Atikaya to regulated heat in human body and drugs preparation. The Tamil Nadu farmer grows ancient rice cultivar Neelam Samba for regulating milk in the mother. The Tamil Nadu Farmer introduces local rice Maappillai Samba to increase fertility in the mother. The Assam farmer cultivated traditional cultivar black rice for mitigating cancer disease and extracted rice bran declines inflammation, allergies, asthma. The Kerala farmer grows local rice Karinjan and Karimalakaran for mitigating diabetes. The Kerala farmer introduces traditional rice Mundakan for increasing the stamina in the human. The Kerala farmer grows traditional rice Vella chennellu and Chuvanna chennellu to reduce puberty, menopause and hormone problems. The Bihar and Chhattisgarh Farmers cultivate Jonga and Maharaji traditional rice for increasing lactation in the mother. The Assam Farmer grows local rice Bora for curing jaundice. The Chhattisgarh and Jharkhand farmers cultivate local rice Karhani to formulate drug for epilepsy treatment (**Ann *et al*., 2019; Krishnankutty *et al*., 2021).**

The kerala farmer burns dry leaves, twigs, and trashes on the ground for the fresh planting of the Banana sucker. 500 gm groundnut cake is applied in the planted banana sucker for better crop growth and yield **(Alexander *et al*., 2009**). Onion, tomato, cowpea, okra are intercropped with banana crop in the early phase for 4 months. The leaves of *Basella alba* (Basale) are kept in the banana gunny bags/ basket. The gunny bags are covered air tight with cover lid. 10 feet pit is dugged out before planting of the grape. The Meghalaya farmer utilizes green leaf manures such as kolangi (*Tephrosia purpurea*), Agave spp. and Ekka (*Calotrpis spp*.) are poured in the 10 feet pit. 10 feet pit is covered with a layer of soil for the decomposition process for 3 months. After 3 months, the grape plant is grown in the 10 feet pit. The powdered groundnut cake is dissolved in the water. The powdered groundnut cake containing water is stored for overnight, Next day, the solution is poured in each pit of the planted grape tree for the better fruit quality and yield. The tip of the grape bunch is thinned for promoting better fruit size. The tip of the pineapple is nipped to obtain more fruit weight and size **(Zizira, 2015).** The farmer cultivates paddy in Mai kaim/jhoom cultivation in hilly areas of tribal Tripura. The farmer's paraboils harvested paddy in the aluminium container and the paraboiled rice dries in the sunlight. The farmer collects forest part and the batch of beetel vine for preparing broom (Boroj). The east siang farmer cultivates local cucurbit cultivars such as pumpkin (tupa), Ash gourd (pani lao), cucumber (makung), ash gourd (pao), bottle gourd (pani lao), smell melon (pakum barey), snap melon (mare/makungmari), sponge gourd (bul), bitter gourd (karela), cho-cho marrow (tupop), ridge gourd (jhika), snake gourd (dunduli), sweet gourd (bhat karela), pointed gourd (patal), ivy gourd/little gourd (kunduli), water melon (kumarah) from the last 5 decades **(Pandey *et al*., 2021)**. The Punjab farmer collects the harvested plant and stubbles are burned in the field for managing termite populations. The residue of tobacco is recommended by the farmer into the soil for controlling termite populations (**Jaskarn and Simerjeet, 2021**). The North-Eastern, Bihar, Jammu and Mahrashtra farmer applies ash in the onion nursery bed and field for progressing bulb quality **(Bhowmick *et al*., 2010**) **(Table 1.1).**

1.2 Indigenous knowledge Practices of farmers in plant protection

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The Punjab farmer proceeded fire in the field after wheat crop harvesting for controlling pests **(Bhuvaneshwari *et al*., 2019).** The Uttarakhand farmers collected the dry leaves of pine and were burned in the field for controlling white grubs. The farmer also applied table salt (NaCl) led Chullahash for controlling white grub. The farmer promoted deep ploughing upto 30 cm depth with indigenous/country plough for damaging insect pests pathogens harbor in the soil (**Surya *et al*., 2021**). The kerala and Jharkhand farmer prepares a mixture of wood ash/ kitchen ash + farm yard manure for arresting the chewing and bitting mouth part insect (**Manoj, 2016**; **Das *et al*., 2003**). The North-eastern, Uttarakhand and Madhya Pradesh framers uses crop such as mustard, cauliflower, cabbage were severely infested with aphid infestation crop, was buried in the soil for aphid control (**Ajay *et al*., 2018**). The Bihar and Uttarakhand farmer incurs earthen up to control greening of potato tubers and checks exposure in sunlight (**Manish *et al*., 2011**). The Orissa and Kerala farmer prepares cow dung + cow urine compound for controlling pesticide, wilt symptoms and onion blight. The Uttarakhand, Orissa, Gujarat farmer promotes Madira or Barnyard millet (*Echinochloa sp.*) and Konri millet crop, mustard intercropped with Paddy crop for controlling insect-pests infestation **(Rajendra *et al*., 2018**). The Chhattisgarh farmer prepares solution with Bicchu booti (*Utrica dioca*) mixes with 8-10 litre cow urine for 24 hrs. The prepared solutions were dispersed in the vegetable crops such as tomato, capsicum, onion, raddish, cucurbits etc. for controlling fungal diseases. The Tamil Nadu farmer collects healthy seeds, performs constant smoking with edible and non edible oil for drying the seeds, mixes ashes of fire wood, mixes with neem powder and stored in the container for controlling pests and diseases in the leguminous seeds, vegetable seeds, maize seeds etc. The North East and Tamil Nadu farmer uses citronella grass and lemon grass for controlling weevil and grain attack of Maize crop. The Tripura and Uttarakhand farmer uses *Zanthoxylum acanthopodium* leaves in the paddy grains for pest and pathogen controls (**Santosh and Chhetry, 2012**). The Tripura farmer recommends wood ashes in the leaves of vegetable crops for controlling aphid pod borer. The farmer uses tobacco dust powder for controlling aphid pest. The Tripura farmer applies Hookah water, is very efficient for restricting major and minor pest and disease such as rice blast, pod borers, sucking bugs in vegetable crops. The Punjab and North-East farmer manages insect-pests of the paddy crop with the leaves of *Artemisia vulgaris*, *Croton caudatulus*, *Munromia wallichi* and *Adhatoda vessica* (**Ahuja *et al*., 2015**). The farmer uses Pomace (wine residue), were made up of millets. The wine residue is dispersed with irrigation channel for controlling leaf folder and rice blast. The North-Eastern region farmer applies oak tree bark, placed through irrigation for controlling insect-pests in rice. The farmer uses 5 months old paddy husk, applies in the field for controlling blast disease and improving soil fertility (**Firake *et al*., 2012**). The Jammu & Kashmir and South Indian farmer recommends *Chrysanthemum coronarium*, *Tagetes erecta* in the border of the crop field for controlling nematode of turmeric, tomato, chlilli and ginger, enhances the soil property and nutrient enrichment. The North-East and Tamil Nadu inhibits stem borer in Paddy with pegging branch of *Cymbopogon khasianum* and *Sacharrum spantaneum* (**Gopal and Lasssaad, 2015**).

The Assam famer distributes banana sucker, a black colocasia, wild turmeric and bamboo perch corner of the field during rice transplanting for controlling pests (**Sarodee *et al*., 2020**). The

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Madhya Pradesh Farmer formulates onion or garlic juice for controlling grasshopper and leaf insects in Maize crop (**Shakrawar *et al*., 2018**). The North-East Farmer pours liquid lime in the Mandarin trunk for controlling Gummosis disease and bark eating caterpillar, trunk borer (**Gohain *et al*., 2019**).

The Punjab and Haryana farmer burns plant debris in the vegetable crop field and paddy crop field for killing harbor of insect. The Tamil Nadu, Kerala and North-Eastern farmer approaches zero tillage practice (dibbling method) for encouraging mycohrrizae root growth and nodulated frankia (**Ngachan, 2019**). The Meghalaya, Jaipur, Punjab and Himachal Pradesh farmer utilizes decomposed mulch for inhibiting the pathogen in the soil **(Rana, 2016**). The Nagaland farmer manages pest of paddy, air borne pathogens and micro climate augmentation with mixed cropping of rice + maize, rice + legume crops, rice + job's tear (*Coix lacryma jobi* L.), rice + sorghum (**Rakesh *et al*., 2017**). The Indian farmer practices deep ploughing after crop harvesting for controlling insect-pests, arthropods, nematode from the soil. The Tripura, Meghalaya and Assam farmer applies burning of paddy husk and dry chilli plant for controlling rodents in the jhum field (**Satyapriya *et al*., 2021**). The Kerala, Tamil Nadu and Uttar Bengal farmer practices dried peel of mandarin in the transplanted rice for controlling stem borer. The termite population is controlled with fermented product of *Agave sissalana* (Agave), *Piper nigrum*, *Veronia amygdalina* and *Nicotiana tabacum*. The Kerala and Orissa farmer uses Datura extracts mixes with cow urine for controlling ant population in the soil (**Patnaik, 2011**). The Punjab farmer applies neem leaves in the grains storage for controlling weevil and grain moth (**Subash, 2017**). The Punjab, Haryana and Telangana uses turmeric powder mixes with water, irrigate in the plant for controlling weevil and grain moth (**Satyagopal *et al*., 2014**). The Sikkim farmer prevents outbreak of aphids and white flies in the tomato and chilli crop with the extract of titey pati, banmara and *Lantana camara* (**Gopi *et al*., 2016**). The Karnataka and North-Eastern farmer are dissolved chilli seedlings in 1:3 solution of cow urine water. The cow urine water assists in protecting seedlings against damping off (**Rakesh *et al*., 2013**).

The Kerala farmer dissolves 400 ml neem oil is dissolved in 400 litre water to produce liquid solution is mixed with 500 gm detergent soap. The prepared solution is sprayed in the mango tree for controlling hopper (**Alexander *et al*., 2009**). The Jorhat and South Indian Farmer dissolves 1 kg cow dung, 5 gm detergent soap in 10 litres water, recommends on mango plant. The prepared solution is effectively control sooty mold disease. Tamil Nadu, Kerala and Himachal Pradesh farmer formulates 1 litre neem oil is dissolved in 100 litres water, is mixed with 500 gm detergent powder. The Banana sucker is immersed into hot water for 30 minutes and controlling rhizome rot. The Tamil Nadu farmer releases dried outer bark of banana once in 4 months. The excision of outer bark of banana prevents root primordia growth, lodging and side sucker emergence. The dried dropping leaves are excise out once in 3 months for avoiding shade effect, mitigating wind damage and preventing lodging. 150 gm neem cake powder is applied in the hole of oozed gum portion. The South Indian and North-Eastern farmers removed wilted banana crop from the pit and is burned and buried in the ground, applies 1-2 kg lime in the individual pit. The Tamil Nadu,

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Kerala and Himachal Pradesh farmer prepares liquid formulation with 1 kg neem powder and 1 kg tobacco powder is dissolved separately in 5 litres water. Next day, the neem powder solution and tobacco powder solution is filtered into fine solution. The neem powder fine solution and tobacco powder fine solution are mixed together to produce compound solution. The banana sucker is dissolved in the compound solution for preventing nematode attack. The Tamil Nadu and Kerala uses 2 kg *Calotrpis spp*. + 3 kg Neem cake are soaked in the 20 litres water, stored for 4 days. Later, the soild parts of *Calotropis spp*. and neem cake are extracted in the 200 litres water. 500 gm detergent powder is dissolved in the 200 litres extracted water. 200 litres extracted water is recommended in the 1 acre of guava orchard for controlling white fly (**Rohini, 2010**).

The Tamil Nadu and North-Eastern farmer is mixed cotton seed with ash and cow dung slurry. The ash and cow dung slurry containing cotton seed are dried in the shade before sowing. The cow dung slurry removes the fibre from the seed, protects against damping off. This method is explained in the Kautilya's Arthashastra (**Manickam *et al*., 2013**). The Assam and South Indian farmer uses clay layer/cow dung ball is poured in the cutted stalk of banana to prevent spoilage and ripening of Banana. The Karnataka, Kerala and Tamil Nadu farmers prepare liquid formulation with 4 kg powdered neem seed is dissolved in 100 litres water. 4 kg powdered neem seed containing 100 litres water is filtered to prepare liquid solution. 10 litre of cow urine is dissolved in the liquid solution. 50 gm detergent powder is dissolved in the liquid solution. The formulated liquid solution is recommended in the citrus tree for managing leaf miner pest and other diseases (**Vanaja *et al*., 2009**). The South Indian Farmer produces liquid formulation with dried neem fruits are crushed to prepare fine powder. The fine powder is applied 500 gm per grape tree for managing nematode attack. 500 gm maida flour is dissolved with 5 litre water. The maida flour containing water is boiled in the gas stove. Later, maida flour containing water is filtered to formulate liquid solution. The formulated liquid solution is mixed with 5 litres cow urine + 50 litres water. The formulated liquid solution is recommended in the citrus tree for controlling sooty mold. The farmer of Karantaka, Mysore and Tamil Nadu are poured leaves of Kasarka (*Stychnos nuxvomica*) with cow dung. The prepared solution is applied in the citrus tree for managing grub insect (**Ravi, 2021**). The dried forest leaves are mulched in the mandarin orange (*Citrus recticulata*) for maintaining soil moisture and temperature. The Assam, Maharashtra farmer applies lime wash/lime soaked cotton in the holes of mandarin orange for controlling stem borer (**Ahuja and Chattopadhyay, 2015**). The South Indian farmer is cutted green aloe vera plant and is applied in mandarin orange tree during flowering phase for controlling powdery mildew disease. The collected orange seed is mixed with ash to restrict ant infestation. The Tamil and Orissa farmer cultivates wild sugarcane with paddy in controlling leaf folder disease (Mayahini *et al*., 2020). The Tamil Nadu and Assam farmer recommends Parasi (*Cleisanthus collinus*) and Sali (*Boswellia serrata*) for controlling caseworm (*Nymphula depunctatis*) in rice (**Kudada *et al*., 2020**).

The Jharkhand farmer applies 10 kg Parso/Persu leaves in 100 m^2 in the paddy field for managing gall fly (Sinha and Singh, 2020). The farmer applies 50-200 kg fresh Karada leaves for controlling Gundhi bug (Chard) from the paddy field **(Richa *et al*., 2017).** The leaf contains high phenol content. The Tamil Nadu farmers extract Cyanodon dactylon leaf for managing fruit borer,

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wilt, leaf curl and early blight in tomato. The Orissa farmer applies compost of cow dung + 10 kg Kochila (*Strychnos nuxvomica*) seed powder + 25 kg kochila leaf compost + compost for managing fruit and shoot borer in the Brinjal crop (**Das *et al*., 2004**). The Jharkhand farmer formulates cow urine mixed with tobacco soaked powder for managing leveas and fruits diseases of cucurbits, cowpea and lady finger **(Devendra *et al*., 2020).** The farmer constitutes liquid solution with rice starch + cow urine for controlling insects and pests in vegetable crops such as ladys finger and tomato (Khudada *et al*., 2020). The Bihar farmer controls shoot and fruit borer in brinjal crop with tobacco soaked water **(Choubey, 2020).** The Tamil Nadu famer applies cow dung slurry for controlling rhinoceros beetle **(Koodalingam *et al*., 2020).**

The Madhya Pradesh farmer recommends dry mahua flower for controlling *Scalopendra spp*. (Gay gwalan) in the soyabean crop. The Tamil Nadu and Madhya Pradesh farmer 100-150 gm Asafoetida ix mixed with 1 litre boiled water for 10-15 minutes, the boiled solution is poured in 40-50 litres water, recommends in the field for controlling the larvae of *Heliothis sp.* and other small insects. The solution of dung waste, crop waste and cow urine is involved in controlling of pest populations **(Ranjay *et al*., 2013).** The Orissa Farmer dissolves dry tobacco leaves in boiled water, transforms into dark black after 10-12 hrs. The dark black solution is sprayed into the larvae of *Heliothis armigera*. The Orissa Farmer prepare liquid formulation with 1000-1200 fresh leaves + buds Ipomea bushes is mixed 30-35 litres boiled water, the boiled water turns into milky white, the liquid solution is recommended in the crop for controlling *Heliothis armigera*, spotted bollworm and army worm. The North-East, Orissa, Tamil Nadu and Bihar Farmers boils fresh neem leaves in 10 litres water, turns into brown liquid in 10-12 hrs, the brown liquid solution is mixed with 80-100 litre clean water, recommends in the crop for controlling specific pests (**Sandhya, 2022**) **(Table 1.2).**

1.3 Indigenous knowledge Practices of farmers in farm machine & tools,

The farmer utilized farm machine & tools in the vedic period. The land preparation implements like la-nogala (small plough) and si-ra (heavy plough), la-n.gala, si-ra (rod), varatra (rope), pha-la (share), yoke (yuga) are traction/animal drawn implement was described in the yajurveda. The farmer involves oxen, sheep, camel for the land development.

The tools like corn cutting tools, a sort of sickle in the shape of cooked knife, sickle and reaping hook was applied in Rigveda period. The farmer utilized the tools for the crop harvesting. In the Rigveda period, the corn grain cleaning was completed with sieve and winnowing fan. The farmer transported harvested grains with the following carts ie., ana-sa (carts) and sfakat.a (wagon). The cart constructed with Acacia tress, Dalbergia trees, bamboo poles and metal tyre (pavi). The wooden cart is transported through Ox, stallion, ram and dog. The Bodos regions farmer utilizes Ruwa (Axe), Kodhal (Digging hoe), Dangur (roke) for eradication unwanted plant material from the crop field. The Assam farmer applies Nangal (plough), Jugal, Mwi, Khodal (digging hoe), Kontha (spua), Gandri or Dangan (leveller) for the field preparation (**Sibisan, 2019**). Simultaheously, The Assam farmer uses Lauthi (digging stick), khopri, Mukha/Kho (mask) for the seed sowing. The farmer uses Phalla (Weighing tool), Nareal Koltha (Coconut cover), Kurai

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Kowrai, Kurai Guhai for measuring harvested agricultural produce. The farmers uses Mosow giri (Bullock cart) for transporting agriculture commodities The Assam farmer recommends Kashi (sickle), Sika (Knife), Sika-gobla (cleaver) for the crop harvesting; applies Baukha, Hukhen (grain separator), Royna, Sandanga (Sieve), Songri (winnower), Khada (Basket made of Bamboo), Duli (grains store), Dingkhi (Grinder), Sundri (small kind of sieve), Khasa (rice store basket) , Gan/Gaihen (milling tools), Val/Ural (Milling tools), Don (Bamboo pan) for post harvesting processings. The Chhattisgarh farmer uses chili (water lifter) for field irrigation (**Nirja and Luke, 2017**).

The Tamil Nadu farmer utilizes country plough (Kalappai) for land preparation. The tamil nadu farmer uses sickle (karukkarival), knife (kambar kathi), Tamarind harvester (Puli kokki), lemon harvesting tool (Ezhumichai karandi) for crop harvesting. The farmer uses weeder (aruguvetti), dry land weeder (cycle gundu), spade (mammutty) for inter-cultural operations. The farmer uses grain separater (kodun kol), wooden thresher (thattuppalagai), stone roller (uruttu kal), bamboo grinder (chekku), milling tool (ulakkkai) for post harvesting of the grains. The farmer uses Pukka, Marakaal, Naali for measuring the agricultural produce. The farmer applies floor cleaner (Sakkai piratti), bamboo pan (moonghil thattu) for cleaning of the grains in the southern region (**Karthikeyan *et al*., 2008**).

The eastern region of farmer applies plough (lungal), spader (plough), khurpa (khurpi), weeder rack, spader (kodal/phaura), guity, sickle (kaste/daw), Daw (katruri), long handle dauli, Axe, sabal, hand stone mill, silpata. paddy spader, bamboo sieve, winnower, silo, bamboo basket, nanda, bankua, mugara (gila),pola, khalui, panki (boti) in crop production and management (**Bikash *et al*., 2015**). The Orissa, Uttar Pradesh and Gujarat farmer applies bullock drawn dhanti for effective control of weed populations in the crop. The indigenous guddeli tools require less power in the operation, prevents the loss of ginger harvesting (**Swain *et al*., 2020**; **Shamkuwar *et al*., 2020**) **(Table 1.3).**

1.4 Indigenous knowledge Practices of farmers in soil and water management

The farmer constructed water reservior, dam, pond, Chauka system and Haveli system for harvesting the water in the Sindhu Valley Civilization. The famer prepares farm ponds, check dams, shallow well dugs for harvesting rain water. The farmer uses Bamboo drip method in irrigation for controlling water borne diseases in terrace farming. The Tamil Nadu farmer applies traditional micro-depression method for managing water in the Neem tree, teak tree and Mango tree for controlling soil erosion, improving soil properties and progressing growth & development of the tree (**Hiswaran *et al*., 2020**). The Andhra Pradesh farmer utilizes rolu method for determining the rain water and collecting the rain water. Rolu is 7.4’ depth, 9 diameter hole granite stone (**Maruthi *et al*., 2020**). The Himachal Pradesh farmer applies Chaal (small water storage ponds) for drinking and irrigation purposes in hill area (**Pradeep *et al*., 2020**). The farmer recommends cow dung slurry for progressing soil property and water retention capacity. The Kerala, Madhya Pradesh, Punjab, Uttar Pradesh farmer improves property of the soil and moisture of the soil with the mixture of wood ash, rice husk and cow dung cake. The wood ash riches in

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phosphorus. The farmer recommends paddy straw mulching for preserving water in the soil and sand bags for controlling soil degradation. The farmer applies mixture of salt ash and coco pit in the field before transplanting. The cocopit contains potassium that improves physical & chemical property of the soil (**Yadav *et al*., 2013; Balasubramanian *et al*., 2009**). The Uttarakhand Farmer constructs water catchment reservoir like Tals, Khals, Chals and Rou for collecting water for domestic and agricultural purposes. The Assam farmer constructs Bari system for harnessing water. The Rajasthan farmer builds Saza Kuva open well for domestic and irrigation uses (**Anwesha and Pardeep, 2020**).

The South Indian farmer grows Aduthininapalai (*Aristolochia bracteolacia*) for evaluating soil water. The mixed cropping and intercropping of leguminous plant facilitates soil improvement. 200 tonnes tank silt are applied in the field for land measures. The sheep/cattle penning improves soil fertility during summer season. The Tamil Nadu farmer restricts soil erosion and moisture with the cultivation of Kolingi (*Tephrosia purpurea*) between fruit trees in sloppy land. The Nuna tree (*Morinda tinctoria*) improves moisture retention in the soil. The deep ploughing encourages moisture content in the soil. The Chhattisgarh, Kerala, Tamil Nadu and Uttar Pradesh farmer prepared a liquid solution with ingredients of 10 kg Neem + 10 litre Cow urine + ½ kg asafetida waste, stores overnight. The extracted liquid manure is applied in the 1 acre land for soil productivity. The mixtures of Neem oil, fine sand and cow dung are stored in the moist area for 3 days. The formulated mixtures are dissolved in the 150 litre water and are recommended in the soil for soil amelioration and sucking pest control (**Ravisankar *et al*., 2017**). The Karnataka, Andhra Pradesh and Kerala farmer cultivates Vetiver (Khus grass) for managing land degradation and soil conservation. The perennial vegetation is cultivated in the field for controlling soil erosion. The farmer applies farm yard manure (FYM) for improving soil property (**Prakasa *et al*., 2015**; **Mishra *et al*., 2011**). The Sikkim farmer constructs terrace in field for promoting terrace farming and land reformation (**Prabuddh *et al*., 2020**).

The Mahrashtra, Kerala and Assam farmer cultivates and ploughs of Diancha (*Sesbania sp*.) snd Sun hemp (*Crotolaria juncea*) improves water holding capacity and soil property of the alkali soil (Shobha *et al*., 2020). The neem leaves are applied for improving alkali soil and saline soil. The Kerala and Tamil Nadu farmer cultivates Poorvarasu (*Thespesia populnea*) mitigates water loss from the soil (**Somasundaram *et al*., 2021**). The Tamil Nadu, Kerala and Karnataka farmer applies bagasse of sugarcane, leaves & branches of Indian gooseberry (*Phyllanthus distichus*) for improving saline soil. The Kerala and Hyderabad farmer cultivates *Tea quadrifolia* and *Cyanodan dactylon* weed encourages high yield on the soil (Binoo *et al*., 2016). The Tamil Nadu, Punjab, Haryana Himachal Pradesh and Maharashtra farmer grows population of Pirandai (*Cissus quandrangularis*) for improving alkali soil property. The South Indian and Uttar Pradesh Farmer cultivate of Diancha and Nut grass (*Cyperus rotandus*) ameliorates the property of alkali soil (**Somasundaram *et al*., 2020**).

The Indian farmer applies cow dung, pig dung, sheep dung and goat dung for progressing soil property. The application of cattle manure in garden soil and wetland and leaf manure in wetland

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are enhanced the property of the soil (**Modupe *et al*., 2020**). The Tamil Nadu, Karnataka, Gujarat and Bihar compound of cowdung, *Calotropis gigantea* leaves, neem cake powder are mixed well and decomposed in the pit. The decomposed manure applies for improving soil property (**Krishan, 2005**; **Krishna *et al*., 2019**). The Bihar and North-East farmer applies water hyacinth as compost or burnt ash for progressing soil and water improvement, provides Potassium (K) nutrient in the soil. The farmer recommends goat manure for improving soil property (**Ganesh *et al*., 2011**). The Rajasthan farmer cultivates green leaf manure such as *Tephrosia purpurea*, *Calotropis gigantea*, *Morinda tinctoria*, *Pongamia pinnata*, *Azadirachta indica*, *Thespesia populnea* and *Adathoda vasica* faciliatates crop growth and soil improvement. The leguminous plant red gram cultivates as green manure crop, encourages for progressing soil property (**Daagar and Teewari**, **2016**) **(Table 1.4).**

1.5 Indigenous knowledge Practices of farmers in animal husbandry

The Dimapur, Assam, Kanyakumari and Goa fish farmer serves pseudostem banana to cater pond fish. The pseudostem banana increases pH and oxygen in the pond water, raise fish production (**Bhalerao *et al*., 2015**). The Maharashtra farmer mixes 500 gm maida + 500 gm behada powder in 2.5 litre water after boiling. The prepared liquid medicine recommends to the cattle for controlling Foot and Mouth Disease (**Choubey, 2005**). The West Bengal, Rajasthan, Uttar Pradesh, Tamil Nadu, Jharkhand, Himachal Pradesh, Uttaranchal and Orrissa farmer prepares liquid medicine with peach leaf extract and milk. The liquid medicine applies to the cattle in the lesion of mouth and hooves control (**Das *et al*., 2004**). The Uttar Pradesh, Maharashtra and Orissa controls foot and mouth disease in the cattle with mixture of babool bark and Jamun bark paste (**Rajesh and Bharathi, 2012**; **Sarita *et al*., 2003**). The farmer controls foot and mouth disease with compositions of camphor and coconut oil in the cattle. The Uttar Pradesh farmer recommends paste of Bantulsi (*Ocimum gratissimum*) leaf along with water for controlling Khurha (FMD) disease in cattle and Buffalo (**Swarup and Pradhan, 2020**). The Uttaranchal farmer prepares liquid medicine with stone apple (bael) and water for controlling diarrhoea (**Mahesh, 2020**). The paste is formulated with 500 gm Shisham leaves and 1 water, is treated in cattle for controlling diarrhoea. The Uttar Pradesh and Uttaranchal farmer prepares pegion waste is mixed with jaggery, is applied in the heifers for inducing oestrus cycle **(Swarup *et al*., 2020).** The Uttaranchal farmer extracted juice of gurhal (urhul) flower treated orally in the goat for controlling diarrhoea (**Dakshinkar and Vihan, 2020**). The Jharkhand farmer applies crushed paste of Pojo (*Litsaea authapoly*) for treating diarrhoea and dehydration (**Haque *et al*., 2020**). The farmer recommends orally flower juice of takala (*Cassia tora*) in goat for controlling diarrhoea. The Himachal Pradesh farmer grinds the leaves of ridge gourd or ekdandi to extract juice. The extracted juice smeared in the wound of the animals (**Varshney, 2020**). The Maharashtra farmer washed and crushed 200-250 gm stem & leaf of Bhangariya (*Eclipta alba*) to produce paste. 50-60 ml mustard oil paste is fried and applied in the cattle, buffaloes and goat for controlling cure blain (**Jangde and Dhanan, 2020**). The Maharashtra and Uttar Pradesh farmer prepares mixtures of 30 gm geru, 50 gm snail shell/sippi are boiled with castor oil and 20 gm Alua, 50 gm kudru/sahjam gum are mixed with the mixture for producing paste. The prepared paste is treated in the bullocks or bulls for controlling

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swelling (**Swarup and Dhakate, 2020**). The Maharashtra farmer prepares the paste of kalajeera is applied to the animal for managing *Haemrrhagic septicaemia* (**Vihan, 2020**). The dairy farmer burns the tick, cultivates high salt plant and avoids shade trees for controlling ticks. The Jharkhand and Himachal Pradesh farmer develops Hajore paste for recovering bone fracture in animal (**Roy and Varshney, 2020**).

The West Bengal fish farmer applies Ghuni, chero/kero, chokhia and atal for trapping fish. Aran bata/ Aran pata utilizes for creating barrier for the fish. The farmer uses circular shaped earthen rings/earthen pots for encouraging catfish breeding in water logged field/ paddy field. Channa gachua (Changmachh) is local fish of majuli island of Assam for curing Asthama and Body pain. The oil of *Mystus vittatus* uses for healing burn injury, fever, bacterial dysentery. The Chela fish (*Salmophasia bacaila*) uses for promoting lacatation in women. The mortality rate of prawn seed forbids with *Cinnamomum tamala*. The leaves have Vitamin A, Vitamin C and anti microbial activity. Ribbon fish (*Lepturacanthus savala*) forecasts cyclone by whistling of the sound. The traditional tool Ankar/Anksi uses for catching mud crabs (*Scylla Serrata*). The unripe gaoh (*Diopyros embryteris*) uses for strengthening of fishing nets in sunderbans (**Aparna *et al*., 2020**).

The Tripura fish farmer produces Lau Macha local fish through fish cum vegetable (bottle gourd. The farmer produces murrels (*Channa spp*.), climbing perch (*Anabas testodeneous*) and cat fish (*Clarias batrachus*) and Bloch (*Heteroneutes fossilis*) in paddy field. The fish controls weed population and soil loosening. The fish cum duckery method grows fish along with duck (**Ratan and Dilip, 2013**).

The West Bengal fisher man manages bloat disease with formulation of 10 gm Bark Aswatha (Banyon, ficuspa) + 10 gm Ada (Ginger) + 10 gm salt. The disease recovers in 7 days. 50 ml liquid common guava leaves is apply for managing diarrhoea. The West Bengal farmer prepares extracts of ganda (Marigold) leaves are mixed for curing wound in animal. The Halud (turmeric) is grinded and applied in animal wound (**Amitedu *et al*., 2004**). The saltation and sun drying is prominent process in fish preservation. The mustard oil and salt and turmeric powder are applied into cutted fish for controlling fish spoilage. The paste is prepared with roots of Bonson tree and 21 pieces Black pepper, fed into the dog bitting portion. The Orissa and Gujarat farmer grinds the stems & leaves of Anantamul for releasing juice, is mixed with honey for managing animal dysentery. The Gujarat farmer formulates liquid solution with 100 gm tulsi leaves and 100 gm basak are boiled with water. The extracted juice is mixed with 1 teaspoon honey and fed to the animal for controlling cold and cough. **(Bikram *et al*., 2012**; **Patel *et al*., 2016**). The Hyderabad farmer uses tamarind bark to prepare glue, is involved in strengthening of the nets. The Uttar Pradesh, Gujarat and Rajasthan farmer pours root of *Acacia arabica* with mustard in 1:3 proportions for managing arthritis. The oestrous cycle of animal treats for 2 days with combination of *Musa paradisiaca* along with sugar (**Ram *et al*., 2013**).

The Uttar Pradesh farmer recommends Vinegar for Tympany medication, Castor oil for Deworming diagnosis, Mustard oil for Body heat regulations, Turmeric lime paste for Sprain heal, Black pepper butter oil mixture for Pneumonia fever control in animal (Gyan *et al*., 2016). The

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Assam, Nagaland, Madhya Pradesh and Haryana Farmers prepare drug with *Glyricidia* and roasted soaked tamarind seeds and fed the cows for increasing lactation. The seeds of subabul cater to animals for improving milk secretion. The Assam, Nagaland, Madhya Pradesh and Haryana Farmers formulate liquid product with Bottle gourd, fenugreek, coconut, black gram and palm jiggery mixed with water, fed to animal for 3 days to increase milk growth. The Assam, Nagaland, Madhya Pradesh and Haryana Farmers feed dried flowers of *Madhuca latifolia* to bullock for improving work efficiency. The Assam, Nagaland, Madhya Pradesh and Haryana Farmers prepare powdered formulation with Pepper, jaggery and betel leaf, fed to animal for increasing digestion rate. The Kashmir farmer serves grinded *Iris kashmiriana* and jiggery to progress milk yield and lean body (**Shubeena *et al*., 2018; Deepandita *et al*., 2021**).

The Hyderabad and Karnataka farmer uses cow dung slurry for managing euglena bloom. The dry fish prepares with intervention of cow dung slurry. 200 gm termite mound soil is boiled with water, the prepared solution is applied to the animal for controlling mastitits, poisonous bite of insects and mechanical injury (**Swamy *et al*., 2015**). The ray fish oil is applied for vanishing boats and controlling leakage. The Bihar and Hyderabad farmer preserves boat & net with cashew shell oil, coal tar and sardine oil. The Hyderabad farmer stores and transports fish by mixing of saw dust and rice. The fish net is strengthened with boiled tamarind seed powder and kalasha bark. The Bihar and Hyderabad farmer diagnoses bloat disease of animal with mango pickle spices and neem leaves. The Bihar, Hyderabad and Orissa farmer controls cattle constipation with *Gardenia resinifera* leaves and *Dendrophthoe falcata* seeds (**Sumit and Shivani, 2021**). A small quantity of curd/butter milk is stored overnight to receive blue-green colour, the solution is involve in de-worming of young calves (**Shenoy, 2021**). The Bihar, Hyderabad and Maharashtra farmer recommends whey milk, onion and custard apple leaves are applied to the animal for managing excess grazing (**Dipika *et al*., 2017**) **(Table 1.5).**

1.6 Indigenous knowledge Practices of farmers in medicinal & aromatic plants for diagnosis diseases,

The Northern Farmer recommends a diversity of medicinal plants for diagnosing the diseases. The Northern Farmer utilizes *Acacia catechu* (khair) for asthama, bronchitis remedy from root part, *Aconitum ferox* wall. (Vatsnabh) for treating Rheumatism from root part, *Aconitum heterophyllum* wall. (Atees) for treating fever, cough, piles and stomach from root part, *Aegle marmelos* (L.) correa (Bell) for curing dysentery, diarrhoea, fever from fruit & bark part, *Alpinia galalnga* (L.) wild. (Kulanjan) for treating Health tonic from bulb part, bulb part of *Andrographis paniculata* (Burm. F.) wall to control malaria, liver, blood purifier, *Aquillaria malaccensis* Lamk. (Agaru) for removing fish spine from throat from the whole part, *Artemisia maritima* L. (Kunja) for curing tonic, blood purifier, fever through whole plant, Berberis aristata DC. (Kingora) for diagnosing eye disease from root & stem, *Cassia augustifoila* Vahl (Senna) for curing rheumatism from the root, *Cholorphytum tuberosum* Bak. (Safed musli) for curing Leucorrhea, sexual tonic from tuber, *Coleus barbatus* Benth. (Patharchur) for treating tonic and blood pressure from root, *Cammiphora wightii* (Arn.) Bhandari for treating Asthma, typhoid from the resin & bark,

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Curculigo orchioides haerten (Kali musli) for curing asthma, dysentery, tonic from the root, rhizome portion of *Curcuma zedoaria* to treat jaundice, blood pressure, seed & fruit portion of *Embelia ribes* to diagnose skin problem, leprosy, *Garcinia indica* choisy (Kokam) for curing skin disease from the fruit, *Gloriosa superb* L. (Kalibari) for treating snake bite, leprosy from rhizome, *Gymnema sylvestre* (Retz.) (Gudmar) for curing Gastric disorder, eye disease from the root & leaf, *Hemidesmus indicus* (L.) Br. for curing cough, hypertension, dysentery from the root, *Myrica esculenta* Ham. exdon (Kaphal) for curing bronchitis, blood purifier, hysteria from the rhizome, *Nelumbo nucifera* barten (kamal phool) for curing chlorea, diarrhoea from fruit & seed, *Ocimum sanctum* L. for treating fever, vomiting, liver & blood purifier from the leaf & seed, *Phyllanthus emblica* L. (amla) for curing fever, vomiting, liver, blood purifier from the seed & leaf, *Picrorhiza kurrooa* Benth. (Katuki) for curing Headache, fever, dysentery from the root, *Pistacacia chinenesis* Bunge (Kakadshingi) for curing cholera, fever, cough from the fruit, root portion of *Piper longum* L. to cure indigestion, child birth, dysentery, *Pistacacia chinensis* Bunge (Sarapagandha) for treating malaria fever, snake bite from the root, *Santallum album* (chandan) for curing dysentery and skin disease from the wood, *Saraca asoca* (Ashok) for treating Heart disorder from the bark & leaf, *Saussurea costus* (Falc.) Lipsch. (Kut) for treating dysentery, asthama, ulcer from the root, *Smilex sp*. (Chopchini) for treating menstrual complain & small pox, *Solanum nigrum* (Giloe) for curing jaundice, bone fracture from the whole plant, *Valeriana jatamansi* (Tagar) for treating epilepsy, urinary complain from the root & leaf, *Withiana somnifera* (Ashwagandha) for treating eye, asthama, cough from the root & leaf, *Wrightia tinctoria* (Indra java) for treating toothache, piles, dysentery from the bark & latex (**Chandra *et al*., 2006**).

The Tripura farmer applies diverse medicinal plant species in the curing mild and acute diseases. The Tripura farmer utilizes traditional plant *Andrographis panicular* for curing dog bite from the leaves, *Phylogacanthus thyrsiflorus* usues for curing cold, cough, asthama from the root, *Achyranthes aspera* uses for curing epilepsy from the root, *Mangifera indica* L. utilizes for treating toothache from the bark & root, *Centella asiatica* L. uses for treating tooth from the whole plant, *Alstonia scholaris* L. uses for treating mother milk from the latex & shoot, *Holarrhena antidysentria* uses for treating dysentery, diarrhoea, anthelmintic from the leaves, *Homalonema aromatic* utilizes for curing snake bite from the leaves & latex, *Ageratum conyzoides* utilizes for curing wounds, cut from the leaves, *Enydra fluctuans* uses for treating bleeding from the leaves, *Spilanthes paniculata* utilizes for treating gastric, stomach problem, throat, diabetes from the whole plant, *Kalanchoe pinnata* uses for curing dysentery from the leaves, *Coccinia grandis* uses for curing diabetes from the leaves, *Momordica cacharantia* uses for curing hand pimples, foot pimples from the leaves & fruits, *Ricinus communis* uses for treating swelling, rheumatism from the leaves, *Acacia concinna* uses for treating diabetes and body pain, *Cajanus cajan* uses for treating jaundice from the leaves, *Cassia fistula* uses for curing laxative from the fruits, *Cassia accidentalis* uses or treating skin disease from the leaves, *Mimosa pudica* uses for curing ring worm, piles from the leaves & root, *Parkia javanica* uti utilizes for curing gastric problem from the fruits, *Lecuas aspera* uses for curing pain, gastric problem, swelling from the leaves & flower, *Ocimum basilicum* uses for curing gastric problem, stomach problem from the leaves & bark,

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Ocimum Sanctum L. uses for treating cough, cold, from the leaves, *Premna sp.* uses for treating ant bite from the leaves, *Litsea glutinosa* uses for curing muscle pain, bone fracture from the bark & leaves, *Hibiscus rosa sinensis* uses for treating irregular menstruation from the root, leaves & bud, *Sterculli aviliosa* utilizes for treating menstruation pain from the leaves. *Moringa oleifera* uses for treating cooling effect from the fruits & leaves. *Psidium guajava* uses for treating diarrhoea, dysentery, piles, vomiting from the leaves, *Nyctanthes arbor-tristis* uses for curing asthama, stomach disorder from the leaves. Aporosa octandra uses for curing injury from the leaves. *Phyllanthus acidus* utilizes for treating chicken pox from the fruits & leaves, *Scoparia daclis* utilizes for treating body pain from the leaves, *Cyanodon dactylon* applied for treating toothache from the whole plant. *Drynaria quercifolia* uses for treating swelling from the rhizome. *Ageles marmelos* uses for curing high fever, malaria from the fruits & leaves, *Murraya paniculata* utilizes for curing toothache from the root. *Flacourita jangomas* uses for curing dysentery, diarrhoea from the fruits. *Aloe barbadensis* utilizes for curing cold, cough from the rhizome, *Curcuma zeodaria* uses for curing stomach, urinary disorder from the rhizome (**Maria *et al.*, 2017**).

The Uttarakhand farmer recommends a diversity of medicinal plants for curing human diseases. The Uttarakhand farmer uses medicinal plant *Aconitum balfourii* (meetha/Bhngwa) for diaphoretic, diuretic, analgesic, anti-inflammatory, anit-pyretic, vermifuge. *Aconitum heterophyllum* (Atees) uses for treating anti-inflammatory, anti-pyretic, anti-bacterial, anthelminthic. *Ajuga parviflora* (Neel Kanthi) uses for curing hypertension, malaria, pneumonia, edema, anit-fungal, hypoglycemic, anit-microbial agents. *Alllium cepa* (Pyaj) uses for curing anti-tumour, anti-diabeteic, anti-allergic and anti –mollusicidal. *Allium sativum* (Lehsum) uses in burn and cut from the whole plant, *Allium wallichii* uses in treating gastric from the leaves, *Angelica glauca* Edgew (choru) uses for treating gastric from the leaves, *Artemisia nilagirica* (kunja) uses for treating cut & wounds from the leaves, *Asparagus filicinus* (Jhirna) uses for treating weakness from the root, *Berberis aristata* (kingod) uses for curing eye ailments from the root, *Bergenia stracheyi* (Pashanbhed) uses for curing stone problem from the root. *Centella asiatica* (Brahmi) uses for treating coolant disease from the leaves. *Cinnamomum tamla* (tejpat) uses for curing blood pressure from the leaves & bark. *Cirisium wallichi* (kanjelu) uses for treating fever from the seeds. *Cucumis sativus* (kakdi) uses for curing diuretic disease from the seeds. *Cucurma longa* (Haldu) uses for treating cut, wound from the root. *Dioscorea bulbifera* (Tairu) uses for treating coolant disease from the tuber. *Eupatorium adenophorum* (Basya) uses for treating cut and wound from the leaves. *Girardinia diversifolia* (kandali) uses for curing fever from the root. *Hippophae salicifolia* (Amesh) uses for treating coolant from the fruit. *Juglans regia* (Akhrot) uses for curing skin disease from the fruit peel. *Jurinea macrocephala* (Biskhanada) uses for curing fever from the root. *Macrotyloma uniflorum* (gahat) uses for curing stone disease from the root. *Megacarpaea polynadra* (Barmolu) uses for treating gastric problem from the root. *Mentha pipertia* (Pudina) uses for curing coolant disease from the leaves. *Mirabilis jalapa* uses for curing cut & wound from the leaves. *Nardostachys jatamansi* (Maasi) uses for treating jaundice from the leaves. *Ocimum corniculata* (Almodu) uses for treating boils from the aerial part. *Paeoni emodi* (chandra) uses for

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treating fever from the leaves. *Picrorhiza kurrooa* (Kadwi) uses for treating fever diseases from the leaves. *Polygonatum verticillatum* (Mahamaida/salampanja) uses for curing fever from the rhizome. *Potentilla lineata* (Bajradanti) uses from treating Anaemia from the fruits. *Rheum moorcroftianum* (Dolu) uses for curing injury, cut and wound from the root. *Rhododendron campanulatum* (Syamru) uses for curing skin disease from the leaves. *Rumex nepalensis* (khuldya) uses for curing pneumonia, cut, wound from the root. *Saussurea costus* (kuth) uses for treating skin disease from the root & leaves. *Saussurea obvallata* (kaunl) uses for treating immune system from the aerial part. *Selinum vaginatum* (bhutkesh) uses for curing coolant disease from the root. *Swertia chiraytia* (chiraitu) uses for curing fever, stomach, ache from the aerial part. *Tagetes erecta* (gainda) for curing ear ache from the leaves. *Taxus wallichiana* (thuner) uses for treating high blood pressure from the bark. *Tinospora sinesis* (giloe) uses for curing fever, stomach, ache from the aerial part. *Utrica dioca* (kundali) uses for treating anaemia, weakness from the aerial root. *Zanthoxylum armatum* (Timru) uses for curing teeth, toothache from thes seed, stem & aerial part (**Ankit *et al*., 2019**).

The Aligarh farmer utilizes Habb-e-Asgand unani drugs for controlling Wajalal mafasil (*Rheumatoid arthritis*) (gaathia) (Verma *et al*., 2021). The Varanasi farmer prepares powdered drug with root of *Anacyclus pyrethrum*, *Withania somnifera*, *Chlorophytum borivilianum*, *Asparagus racemosus* and tuber of *Pueraria tuberosa* for stimulating male sex hormone (**Kumar *et al*., 2021**). The Meghalaya farmer uses liquid of pseudostem of *Ensete glaucum* (roxb.) cheesman contains aminoacid, cardiac glycosides, flavonoids, polyphenol, alkaloids, reducing sugars, starch, saponins, tannins, terpenoids, oil and fats for diagnosing diarrhoea (**Joga *et al*., 2020**). The Solan district farmer of Himachal Pradesh recommends *Cryptolepis buchananii*, *Eucalyptus citriodora*, *Ligustrum japonicum*, *Pinus roxburghii*, *Rosa alba*, *Ziziphus nummularia* and *Sonchus oleraceus* for treating skin infections. The Solan district farmer of Himachal Pradesh recommends *Rhododendron arboreum*, *Zanthoxylum armatum*, *Viola canescens*, *Quercus leucotrichophora*, *Rubus ellipticus*, *Punica granatum*, *Ocimum sanctum*, *Morus nigra*, *Mentha arvensis*, *Justicia adhatoda*, *Ficus benghalensis*, *Eriobotrya japonica*, *Debregeasia longifolia*, *Cissampelos pareira*, *Datura innoxia*, *Eucalyptus citriodora*, *Cynodon dactylon*, *Colebrookea oppositifolia* and *Cannabis sativa* for treating diarrhea, diabetes, dysentery, cough, cold and fever (**Kumar *et al*., 2021**).

The Adi community of Arunachal Pradesh treats asthma, bronchitis, cough, sinusitis, diabetes, malaria, typhoid and jaundice with the involvement of Frangipani, periwinkle, turkey berry, Night shade, Indian trumpet flower and Giloy (**Ranjay *et al*., 2020**). The Himalayan cold desert region of Ladakh people involves in monastery constructions, increases preparations, fuelwood and fodder crops with *Juniperus polycarpus* C. Koch (Himalayan pencil cedar) (Dorjey and Maurya, 2020). The Uttarakhand farmer recovers skin disease problem with Hairy beggarticks and Deodar. The constipation and lier disorder are treated with *Eclipta alba*, *Mallotus philippensis*, *Boehmeria rugulosa*, *Celtis australis*. The cosmetic produces with *Aretmisia annua*, the insect bites, infertility problem recovers *with Parthenium hysterophorus*, the human stone problem is treated with *Chenopodium album* and *Berginia ciliate*. The human tooth problem treats with

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Xanthium stramonium. The blood dysentery cures with *Boerhavia diffusa* and *Sterculia villosa*. The human muscular pain & swelling are cured with *Helicteres isora*, epilepsy problem cures with *Artemisia japonica*. The human cut and wound are treated with *Ageratum conyzoides, Brassica campestris, Betula utilis, Achyranthus aspera, Colebrookia oppositifolia, Rumex hastus* and *Bergenia ciliata*. The urinary disorder, headache and menstrual disorder are rebommended with *Fagopyrum esculatum*. The children worm restricts with *Amaranthus paniculatus*. The human stomach problem is cured with *Artimisia maritime, Cyanodon dactylon* and *Syzgium cumini*. *Bombax ceiba* uses in piles disease. *Treminalia chebula* uses in indigestion problem. The fractured bone is treated with *Litsea chinenesis*. The bite of *scorpion* is cured with *Amaranthus spinosus*. The human memory enrichment is stimulated with *Centella asiatica* (**Aakash *et al.*, 2021**). The garo tribe farmer utilizes more 36 tree, 5 shrubs and 2 creeper/climbers for cooking and medicinal purposes **(Singh and Mathew, 2020).** The community of Dongria Kandha tribes uses traditional medicinal plant *Discorea bulbifera* L. for curing cancer, HIV, anti-inflammatory, anti-microbial, cardioprotective and anti-hyperthyroid activities (**Parida and Sarangi, 2020**). The seed of *Manikara zapota, Caatinga biome, Moringa oleifera, Carica papay*a, *Myracrodruon urundeuva* involves in controlling *Ades agegypti* mosquito populations. The seed protein of *Jatropha curcas* and leaves protein of *Solanum villosum* are recommended for restricting *Culex quiinquefasciatus* and *Ades aegypti* populations (**Manisha and Neelam**, 2021). The Uttar Pradesh farmer controls Bovine herpes virus type I, foot and mouth disease virus and new castle disease virus in animal with sacred plant *Ocimum tenuiflorum* and *Ocimum sanctum* (holy basil/tulsi) (**Goel and Bhatia, 2022**). The Jammu farmer uses non timber forest product *Aconitum heterophyllum* wall. (Patis, Aconite, Dhar buti, Attees or Bis Mohra) for intestinal worms, diarrhoea, dysentery, high fever and anti-rheumatic. The disease of fever, cold, cough, hypertension, muscle spasms, parasitic worms and malaria root are diagnosed with the rhizomes of *Viola odorata* (Bnafsaha, wild violet, sweet violet). The root of *Valeriana jatamansi* (mush khala, jatamansi, balchhari, mansi, nihani) uses for treating eye, blood liver problem, hysteria, nervous andurinal stress. The root & rhizomes of *Picrorhiza kurroa* (Kaud, kaur, kutki) uses in fever, cold cough, hypertension, muscle spasms, parasitic worms and malaria. The root of *Bergenia ligulata* (patharchoor, pashanbeda) uses for healing of wound (**Bagal *et al.*, 2022**). The powdered medicine recommends in management of longevity, anti-viral, analgesiscs, ascites, hypoglycemic, anti-arthritic and anti-ageing (**Manosi *et al.*, 2022**) **(Table 1.6).**

1.7 Indigenous knowledge Practices of farmers in stored grain pests' management

The farmers initiated grains storage in the mid historic period. The Uttar Pradesh and Tamil Nadu farmer constructed gowdowns with straw, leaves and the godowns mounted with cow dung. The grains stored in the surface (**Vishal *et al.*, 2020**). The cleft of the godowns mounted with rod, cow dung led mud. The construction and storage of food grains was described in the Vishwakarma vastu sastra. The Tamil Nadu farmer mixes 200 gm of common salt in red gram/Arhar for controlling stored grains pests. The Tamil Nadu farmers mixes and treats sorghum seed at 1:4 ratio in jute gunny bags for 6 months storage of seed and controlling pest problems. The Tamil Nadu farmer controls storage pests and insect-pests with the liquid solution of neem oil + coconut

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oil/castor oil. The Tamil Nadu farmer applies 5 litre groundnut oil and ¼ kg tamarind in the container. The container covered with cotton cloth tight for ground nut oil storage. The farmer applies 100 gm coriander seeds, a litre of oil, a spoon of salt in the container. The coriander seed releases odour in the oil that prevents oil spillage and oil spoilage (**Karthikeyan *et al*., 2009**). The Tamil Nadu, Kerala and Karnataka farmers controls flat grain borer, lesser grain borer and saw toothed beetle by blending ragi grains into neem leaves, thumbai and any strong odour leaves (Kaddi patta, tulsi, lemon grass etc). The Manipur Farmer exposes stored pulse grain in the open sunlight at 20 °C for controlling *Callosobruchus chinensis* eggs and grubs (Adesina *et al*., 2019). The Karnataka Farmer prepares Custard apple seed powder, recommends Pulse grains to conrol bruchid adult and eggs (**Prakash *et al*., 2016**).

The Tamil Nadu, Kerala, Telangana and Karnataka farmers is stored pegion pea seed with horse gram seed dust the air tight container. The horse gram dust assimilates excess moisture and encourages long term storage. 10 kg pegion pea seed mixes with 1 kg fine red soil for controlling moisture permeability and storage pest (**Shaila and Nafeesa, 2021**).

The Tamil Nadu, Uttar Pradesh and Mahrashtra farmer constructs godowns/granary room with brick and wooden boards for controlling rice moth and restrict moisture of the grains (**Parimala *et al*., 2013**). The Manipur and Tamil Nadu farmer maintains short term grain storage with 1 gm camphor per 5 kg grains in the jute bags. The Manipur farmer prepares plate like round shaped structture (Varati) with the help of fresh cow dung, the seed were enclosed in the Varati for 2-3 days under sunlight. The enclosed seed stored into the wooden boxes upto 1 year for seed storage and increasing 90% seed germination (Adesina *et al*., 2019). The seed materials of the crops are poured into ¾ th height earthen pot; the pot covers with rough cloth containing with neem leaves, pungam leaves and notchi leaves. The quantitiy of the sand covers the mouth of the container. The pulses and food grains are immersed into 10% salt solution and dreid for controlling pest attack. The application of Neem leaves/ Pungam leaves manage storage pest of cereal crops. The Karnataka, Assam and Kerala farmer practices 10 gm lime per kg grains in jute gunny bags for storing 1 year grains storage. The Karnataka and Tamil Nadu farmer mixes gingelly seed with 100 gm paddy in the container for the 3 months gingelly seed storage, controlling Indian meal moth (*Plodia interpunctella*) (**Bhavani and Ningdalli, 2015**).

The Tamil Nadu farmer operates long term storage by blending 1 kg pulse seed in 20 ml neem oil and controls weevils, long headed flour beetle, red flour beetles and fig moth during storage. The salt treatment conducts breakage of seed dormancy and increases drought stress tolerance (**Marziyeh *et al*., 2017**). The Gujarat and Orissa farmer controls Angoumois grain moth and rice weevils by recommending Pungam leaves in the paddy gunny bags and manages long term storage (**Sahu *et al*., 2022**). The North-East, Tamil Nadu, Punjab and Haryana farmer places paddy husk upto 5 cm in top portion of the earthen pot for seed damage control and pest control. The Tamil Nadu, Kerala, Orissa and North-East farmer practices 2kg paddy seed + 1 kg salt + 10 litre water places in the sunlight for an hour. The chaffy seed is separated from the hard seed. The hard seed

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is dried in the shade. The addition of salt increases the density, separates light seed and chaffy seed. It also increases the seed germination (**Bordoloi *et al.*, 2017**; **Singh, 2018**).

The North-Eastern and Karnataka Farmer pours paddy seed in the water for 12 hours. The dried paddy seed is placed in the pit contains tree saw dust and sheep manure. The pit is covered tightly with plastics/cotton cloth. The seed are excised out after 2 days drying for spawing. The air tight container creates heat inside the pit for seed germination. 10-15 kg paddy bag placed enhance of the house instead of doormat for 1-2 years paddy storage. The regular stepping of the bag disturbs insect movement and seed feeding. The proportion of 1:10 salt and water solution is poured 10 kg paddy seed. The dried seed is recommended for sowing after 72 hrs. The North-Eastern, Tamil Nadu, Madhya Pradesh and Karnataka Farmer 1 kg sorghum seed dissolves in 100 gm dry cow dung powder + 250 ml cow urine for an hour before sowing and improving seed germination. The dissolves sorghum seed in 1kg lime + 10 litre water for 10 days. The North-Eastern and Karnataka Farmer seed is dried in shade before sowing. The lime prevents attack seed borne diseases such as smut & bunt. The healthy ear head led with awn of sorghum is kept with dried paddy grass heap (banave) for controlling seed damage and improving seed longevity. The North-Eastern, Telangana and Karnataka Farmer is stored pegion pea seed with dry powder bitter gourd and drum stick seed for 3-6 months for controlling insect-pests. The North-Eastern and Karnataka Farmer is mixed 10 kg green gram seed with 250 gm chilli powder + 1 kg ragi/finger millet flour. The prepared mixtures are stored in the bamboo pot along with paddy husk. The chilli powder and flour prevents attack of storage pests. This practice is mentioned and explained in the Varabamihira's Brihat Jataka (**Rakesh *et al.*, 2013**; **Ambika *et al.*, 2014**).

The North-Eastern, Uttar Pradesh, Himachal Pradesh and Kerala farmer dissolves dry cow dung with ghee + honey for the seed treatment in Kautilya period (**SCERT, 2016**). The Uttar Pradesh, Karnataka and Orissa farmer treats pegion pea seed with dry pongamia leaf for controlling storage pests. The North-Eastern, Kerala, Andhra Pradesh and Karnataka Farmer are stored pegion pea seed with dry guntur chilli powder and neem leaf powder for controlling insect-pests and seed senescence. The Kerala, Andhra Pradesh and Karnataka Farmer controls insect-pests in chicken seed either by mint leaves powder or sweet flag root powder. The North-Eastern, Kerala and Karnataka Farmer are stored chilli seed in the gunny bag and kept in a hot water for a day. This practice improves seed availability and vigour. The North-Eastern, Kerala and Karnataka Farmer applies dried fruit of sponge gourd after removing seed in the sunflower seed store. The dried fruit of sponge gourd containing sunflower seed is kept in the air tight container. The North-Eastern, Kerala and Karnataka Farmer uses protective capsule of sponge gourd protects against storage pests of Sunflower seed. All crops dried seeds and grains are restricted the invasion of pest attack on new moon day (**Usharani *et al.*, 2019**; **Jyoti *et al.*, 2020**). 5 kg pegion pea/chick pea seed is mixed with pearl millet/ finger millet. The mixed seed is placed in the earthen pot and sealed with cow dung smear. The millet assimilates moisture content in the pot for pulse seed storage. The green gram seed is stored in the layer of ash in the earthen pot. The earthen pot is smeared with cow dung. The insect population is died of ash suffocation, the seed is stored for the longer period. The Orissa, Telangana and Maharashtra farmer manages insect pest and microbe of chickpea such

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as *Alternaria sp*. or *Fusarium sp.* by blending of 100 kg chickpea seed with citronella leaf oil/cotton seed oil/ soyabean oil/ castor seed oil (**Ruparao *et al*., 2018**). The Punjab, Haryana, Rajasthan, Uttar Pradesh and Karnataka farmer are stored dried leaves of neem in the grains warehouse, are stopped the attack of stored grains pest (**Yallappa *et al*., 2012**). The Tamil Nadu, Madhya Pradesh, Assam, Uttar Pradesh and Uttarakhand Farmer are stored dried leaves of notchi (*Vitex negundo*) into the seed materials, stops the attack of stored pests (**Shivankar *et al*., 2006**). The Tamil Nadu farmer poured 1 kg Vasambu (*Acorus calamus*) in 50 kg grains, forbids invasion of stored pests and enhances 1 year storage period (**Kathirvelu *et al*., 2019**) **(Table 1.7).**

1.8 Indigenous knowledge Practices of farmers in weed management

The Uttarakhand and Karnataka farmer cultivated jethi rice, finger millet, black soyabean, horse gram in weed control and moisture conservation (**Nautiyal *et al*., 2017**; **Reddy *et al*., 2008**). The volunteer plant emerges in the field of rice crop field, eradicates with the help of Danala implement for weed control. The Jammu and Kashmir, Haryana, Himachal Pradesh, Uttar Pradesh, parts of Sikkim, West Bengal and Arunachal Pradesh farmer disperses dry leaves of pine into the field in the middle of the june, fired in the field for the weed control. The farmer described that the population of weed available in the dryland field then conserves soil moisture. The Meghalaya and Mahrashtra farmer applies Common salt (NaCl) for eradicating *A. conyzoides* and *Crassocephalum creidioides* weed plant (**Patel *et al*., 2015**).

The North-Eastern Farmer maintains weed population of *Cyanodon dactylon* in the soil field for 3 yrs then conserves the soil moisture (**Gulab *et al*., 2018**). The North-Eastern, Orissa, West Bengal, Tamil Nadu and Karnataka Farmer inhibit weed population with the production of green leaf manure such as *Sesbania sp*. and *Tephrosia purpurea*. The farmer prepares 1 kg salt + 100 gm sarvodaya solution for restricting the growth of Nut grass weed plant. The cultivation of *Calotropis gigantea* restricts Aarai (Mars/*Tea quadrifolia*) weed population (**Ramyajit and Saumi, 2019**). The farmer discharges volume of water in the field for managing volunteer seed and plant. The Tamil Nadu farmer applies 200 gm Salt dissolves in 1 litre water solution in controlling Congress weed (*Parthenium hysterophorus*). The Tamil Nadu, Kerala, Himachal Pradesh, Assam, Meghalaya and Kerala Farmer applies 50 kg Neem cake in the field for controlling Nut grass (**Surinder *et al*., 2018**) **(Table 1.8).**

1.9 Indigenous knowledge Practices of farmers in food product

The North-East farmer formulates indigenous pickle and Chatni with ingredients of wild type mesta and Roselle (*Hibiscus subdoriffa*). The biochemical contents Citric acid, ß carotene, malic acid, Vitamin C, allo-hydroxycitric acid protein, total sugar and tartaric acid are sysnthesized through biodynthetic pathway in Roselle. The North-East tribal community consumes fruit and leaves of wild brinjal in the home. The Phatthalung Province Farmer involves composition of Sangyod rice flour and wheat flour for producing indegnous wheat bread (**Jiraporn, 2018**). The tribal people of Arunachal Pradesh prepared fermented food such as gundruk, sinki, anishi, Bhatooru, Marchu and Chilra, Kienma, Tungrymbai, Mesu, Soibum, Ngari, Hentak, Kadi, Churpa/Churpi and Nadu, ghanti, Jann/Jaan and Daru (**Nazish, 2013**).

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The Nagaland community cooked Meat with fermented plants like *Amaranthus* sp., Bamboo shoot, *Brassaiopsis* sp., *Chenopodium album*, *Colocasia esculenta*, *Curcuma angustifolia*, *Fagopyrum esculentum*, *Hibiscus sabdariffa*, *Oenanthe stolonifera*, *Persicaria chinensis*, *Polygonum molle*, *Zanthoxylum armatum* and *Zanthoxylum rhetsa*. The Nagaland community prepares Galho rice either with wild leaves; mixtures of Salt, garlic, potatoes, tomatoes, dry fish & fermented soyabean and *Perilla frustescens* Seeds for increasing taste quality. The Nagaland community prepares Tathu chutney with chilli paste, leaves and dry meat or fermented fish. The Modi is a piece of Mithun, beef or pork, is prepared with ginger, garlic, onion, chilli, and salts by the Nagaland tribe. The Nagaland tribe prepares Ghabe food with boiling of leaves with addition of spices, chilli, fermented Soyabean or dry fish. The Nagaland tribe prepares Galkemeluo food with boiling of wild leaves with bamboo shoot, garlic, tomato, potato, dry or smoked meat, dry fish, fermented soyabean, *Zanthoxylum rhetsa* and *Zanthoxylum armatum* (**Singh and Teron, 2017**). The Mizoram community prepares fermented pig fat with chopped pieces of inner abdominal portion of pig. The Mizoram community extracts oil with fermented Seasame for cooking the food. The Mizoram community performs sun drying leaves of *Hibiscus sabdariffa* Linn prepares either with seasonal vegetables and fish, chicken, beef, pork for eating source. The Mizoram community prepares fermented crabs with sesame oil. The Mizoram community prepares smoked meat Wild animals such as barking deer, sambar deer wild boar, macaque, birds, squirrels and rodents with thick pointed Bamboo sticks (**Lalthanpuii *et al*., 2015**). The Manipur tribe prepares Tunateinzi food with ingredient of rice flour and sugar, Lengchiphon food with ingredient of rice flour and liquid sugar. The Manipur and Nagaland Tribe prepare Ganang Tamdui food with fermented mustard leaves and banana leaves. The Manipur, Mizoram, Sikkim and Darjeeling Tribe prepare Gundruk food with dried mustard leaves. The Manipur Tribe prepares Bi-kang food with boiling and drying of *Colocasia*. The Manipur, Mizoram, Sikkim and Darjeeling community prepare fermented Soyabean for using in curry and chutney. The Manipur community prepares Gankhiang-khui food with alkaline fermented seeds of *Hibiscus canabinus*. The Manipur community prepares food with *Auricularia auriculari*, *Schizophyllum commune* and *Lentinula edodes* wild mushrooms (**Thangjam *et al*., 2018**).

The Manipur farmer produced from edible Bamboo species such as *Bambusa Cephalostachyum*, *Chimono Bambusa*, *Dendrocalamus sp*. and *Melocanna sp*. for culinary and product uses, prepares bamboo shoot curry (Usoi Ooti), Bamboo shoot salad (Usoi Kangsu), Bamboo shoot chutney (Soibum), Fermeneted shoot curry (Soibum Thonga), Fried Bamboo shoot (Laiwa Kanghou), Boiled Bamboo shoot (Usoi Champhut), Bamboo shoot pickles (Usoi aachar) (**Premlata *et al*., 2020**). The Bhotia community of Uttarakhand applies the genera of wild edible fruit such as *Cotoneaster* sp., *Fragaria* sp., *Malus sp*., *Prunus* sp., *Rosa* sp., *Sorbaria* sp. and *Sorbus* sp. for preparing local beverage (Aygar), tobacco pickles, chutney oil, furniture and agriculture tools & implements (**Badal *et al*., 2022**) **(Table 1.9).**

Conclusion

The traditional knowledge of agriculture is followed by the Indian farmers for the crop production and farm linked activities. The farmer compliances ritual in agriculture for the production and other activities in rural areas. The agriculture aspirants will receive the scope and imperative of indigenous agriculture. The forefather agriculture information are compliance by the farmer for agricultural activities. The inclusion of traditional the agriculture in the course would be outlined about the history of the agriculture work and technology enhancement through traditional agriculture.

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Table 1.1: Indigenous knowledge of farmers in crop production and management				
S.No.	**Indigenous Traditional Knowledge (ITK)**	**Cause**	**State**	**References**
1	Digging and Drying of grafted Mango pit	eradication of weeds, pests, insects	Himachal Pradesh	Kranthi *et al*., 2016
2	Sunflower cultivation in between mango trees	attract honey bees and raises pollination and fruit production	Tamil Nadu and North eastern	Das *et al*., 2019
3	Storing of mango fruit on the paddy straw	uniform ripening of the mango fruit	Andhra Pradesh	Mangla, 2009
4	Burning of dry leaves and twigs	fresh planting of the Banana sucker	Kerala	Alexander *et al*., 2009
5	Green leaf manures such as kolangi (*Tephrosia purpurea*), Agave spp. and Ekka (*Calotrpis spp.*)	Cultivation of grape plant after 3 months	Meghalaya	Zizira, 2015
6	Cultivation of local cucurbit cultivars such as pumpkin (tupa), Ash gourd (pani lao), cucumber (makung), ash gourd (pao), bottle gourd (pani lao), smell melon (pakum barey), snap melon (mare/makungmari), sponge gourd (bul), bitter gourd (karela), cho-cho	Local cultivars Conservation	East siang, Arunachal Pradesh	Pandey *et al*., 2021

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	marrow (tupop), ridge gourd (jhika), snake gourd (dunduli), sweet gourd (bhat karela), pointed gourd (patal), ivy gourd/little gourd (kunduli), water melon (kumarah) since 5 decades			
7	Burning of harvested plant and stubbles	termite population control	Punjab	Jaskarn and Simerjeet, 2021
8	ash in the onion nursery bed and field	progressing bulb quality	North-Eastern, Bihar, Jammu and Mahrashtra	Bhowmick *et al*., 2010
9	Pit Nursery Method	water and evapo-transpiration loss	Manipur Farmer	Ansari *et al*., 2021
10	*Paira* cropping system in rice lowlands with broadcasted Lathyrus seeds in main field	water management	Jharkhand Farmer	Dey and Sarkar, 2011
11	Cultivation of Indigenous rice Tulshi tall	Mitigation of type II, diabetes, obesity, and cardiovascular diseases	Farmers of Western Ghat zone of Maharashtra	Ann *et al*., 2019; Krishnankutty *et al*., 2021
12	Cultivation of Indigenous rice Vikram	Mitigation of type II, diabetes, obesity, and cardiovascular diseases	Farmer of Konkan region of Maharashtra	Ann *et al*., 2019; Krishnankutty *et al*., 2021

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13	Cultivation of Tulaipanji traditional aromatic rice variety	aroma seed quality	Northern district of West Bengal farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
14	Cultivation of traditional aromatic rice cultivar Jatu rice	aroma and taste	Farmer of Kullu valley of Himachal Pradesh	Ann *et al*., 2019; Krishnankutty *et al*., 2021
15	Cultivation of Matali and Lal Dhan local rice cultivars	Diagnosis of fever and reducing blood pressure	Himachal Pradesh farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
16	Cultivation of traditional red rice variety Kafalya	Curing leucorrhoea and complicated abortion	Himachal Pradesh and Uttar Pradesh Farmers	Ann *et al*., 2019; Krishnankutty *et al*., 2021
17	Cultivation of traditional rice cultivar Kari Kagga and Atikaya	Human body heat regulation and drugs preparation	Tamil Nadu Farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
18	Cultivation of ancient rice cultivar Neelam Samba	Milk regulation in Mother	Tamil Nadu Farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
19	Cultivation of local rice Maappillai Samba	Increase mother fertility	Tamil Nadu Farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

20	Cultivation of traditional cultivar black rice	Mitigation of cancer disease	Assam farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
21	Cultivation of local rice Karinjan and Karimalakaran	Diabetes control	Kerala farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
22	Cultivation of traditional rice Mundakan	Increase human stamina in	Kerala farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
23	Cultivation of traditional rice Vella chennellu and Chuvanna chennellu	Reduction of puberty, menopause and hormone problems	Kerala farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
24	Cultivation of Jonga and Maharaji traditional rice	increasing mother lactation	Bihar and Chhattisgarh Farmers	Ann *et al*., 2019; Krishnankutty *et al*., 2021
25	Cultivation of local rice Bora	curing jaundice	Assam Farmer	Ann *et al*., 2019; Krishnankutty *et al*., 2021
26	Cultivation of local rice Karhani	formulation of drug, epilepsy treatment	Chhattisgarh and Jharkhand Farmers	Ann *et al*., 2019; Krishnankutty *et al*., 2021

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Table 1.2: Indigenous knowledge Practices of farmers in plant protection

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Fire in the wheat crop field after harvest	pest control	Punjab	Bhuvaneshwari *et al*., 2019
2	Burning of dry leaves of pine	white grubs control	Uttarakhand	Surya *et al*., 2021
3	Preparation pf a mixture of wood ash/ kitchen ash + farm yard manure	chewing and bitting mouth part insect	Kerala and Jharkhand	Manoj, 2016; Das *et al*., 2003
4	Decomposition of aphid infestation crop such as mustard, cauliflower, cabbage	aphid control	North-eastern, Uttarakhand and Madhya Pradesh	Ajay *et al*., 2018
5	Earthen up of potato	greening of potato tubers and check exposure in sunlight	Bihar and Uttarakhand	Manish *et al*., 2011
6	Preparation of cow dung + cow urine compound	wilt symptoms and onion blight control	Orissa and Kerala	Rajendra *et al*., 2018
7	Intercropping of Madira or Barnyard millet (*Echinochloa sp*.) and Konri millet crop, mustard with Paddy crop	insect-pests infestation control	Uttarakhand, Orissa and Gujarat	Rajendra *et al*., 2018

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8	Liquid solution of Bicchu booti (*Utrica dioca*) mixes with 8-10 litre cow urine	anthracnose in chilli, Tomato late blight & fruit rot and Cucurbit Alternaria blight	Chhattisgarh	Santosh and Chhetry, 2012
9	Collection of healthy seeds and constant smoking with edible and non edible oil,	drying of the seeds	Tamil Nadu	Santosh and Chhetry, 2012
10	Aromatic plants: citronella grass, lemon grass	maize weevil & grain storage, pests of pomelo	North East and Tamil Nadu	Santosh and Chhetry, 2012
11	Application of *Zanthoxylum acanthopodium* leaves in the paddy grains	pest and pathogen controls	Tripura and Uttarakhand	Santosh and Chhetry, 2012
12	Application of wood ashes in the leaves of vegetable crops	aphid pod borer controls	Tripura	Ahuja *et al*., 2015
13	Application of Hookah water in vegetable crops	major and minor pest and disease such as rice blast, pod borers, sucking bugs controls	Tripura	Ahuja *et al*., 2015
14	Application of oak tree bark	insect-pests control in rice	North-Eastern	Firake *et al*., 2012
15	Bordering of *Chrysanthemum coronarium*, *Tagetes erecta* in the crop field	turmeric, tomato, chlilli and ginger nematode control	Jammu & Kashmir and South Indian	Gopal and Lasssaad, 2015

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16	*Cymbopogon khasianum*, and *Sacharrum spantaneum* pegging branches	Paddy stem borer control	North-East and Tamil Nadu	Gopal and Lasssaad, 2015
17	Burning of plant debris	killing harbor of insect in paddy field and vegetable field	Punjab and Haryana	Ngachan, 2019
18	Decomposed mulch	Inhibition the pathogen in the soil	Meghalaya, Jaipur, Punjab and Himachal Pradesh	Rana, 2016
19	Mixed cropping: rice + maize, rice + legume crops, rice + job's tear, rice + sorghum	pest control of paddy, air borne pathogen control and augmenting micro climate	Nagaland	Rakesh *et al*., 2017
20	burning of paddy husk and dry chilli plant in the jhum field	rodent controls	Tripura, Meghalaya and Assam	Satyapriya *et al*., 2021
21	Application of dried peel of mandarin in the transplanted rice	stem borer controls	Kerala, Tamil Nadu and Uttar Bengal	Patnaik, 2011
22	Datura extracts mixes with cow urine	ant controls	Kerala and Orissa	Patnaik, 2011
23	Application of neem leaves in the grains storage	weevil and grain moth controls	Punjab	Subash, 2017

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

24	Irrigation of turmeric powder with water	weevil and grain moth controls	Punjab, Haryana and Telangana	Satyagopal *et al*., 2014
25	fermented extract of titey pati, banmara and *Lantana camara*	aphids and white flies controls in the tomato and chilli crop	Sikkim	Gopi *et al*., 2016
26	Treatment of 1:3 solution cow urine water of seedlings of chilli	damping off control	Karnataka and North-Eastern	Rakesh *et al*., 2013
27	Formulation of liquid solution with 400 ml neem + 400 litre water + 500 gm detergent soap.	hopper control in mango	Kerala	Alexander *et al*., 2009
28	Formulation of liquid solution with 1 kg cow dung + 10 litres water + 5 gm detergent	sooty mold control in mango	Jorhat and South	Rohini, 2010
29	Immersion of Banana sucker in hot water for 30 minutes	rhizome rot control	Tamil Nadu, Kerala and Himachal Pradesh	Rohini, 2010
30	Burn and Bury of banana crop in the ground	wilt control	South Indian and North-Eastern	Rohini, 2010
31	Dissolving of Banana crop in the formulated solution with 1 kg neem powder + 1 kg tobacco powder + 5 litres water.	nematode control	Tamil Nadu, Kerala and Himachal Pradesh	Rohini, 2010

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

32	Formulation of liquid solution with 2 kg *Calotrpis spp*. + 3 kg Neem + 20 litres water, 500 gm detergent powder + 200 litres water.	white fly control in guava	Tamil Nadu and Kerala	Rohini, 2010
33	Mixing of cotton seed with ash + cow dung slurry	damping off control	Tamil Nadu and North-Eastern	Manickam *et al*., 2013
34	Pouring of clay layer/cow dung ball in the cutted stalk of banana	prevent spoilage and ripening of Banana	Assam and South Indian	Vanaja *et al*., 2009
35	Application of dried neem fruits fine powder	nematode control	South Indian	Ravi, 2021
36	Application of 5 litres cow urine + 50 litres water	sooty mold control in citrus tree	South Indian	Ravi, 2021
37	Application of leaves of Kasarka (*Stychnos nuxvomica*) + cow dung	grub insect control in citrus tree	Karantaka, Mysore and Tamil Nadu	Ravi, 2021
38	Application of lime wash/lime soaked cotton in the holes of mandarin orange	stem borer control	Assam, Maharashtra	Kudada *et al*., 2020
39	Application of cutted green aloe vera plant in mandarin orange tree	powdery mildew disease control	South Indian	Kudada *et al*., 2020
40	cultivation of wild sugarcane with paddy	leaf folder disease control	Tamil and Orissa	Kudada *et al*., 2020

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41	10 kg Parso/Persu leaves in the paddy field	gall fly control	Jharkhand	Sinha and Singh, 2020
42	50-200 kg fresh Karada leaves in the paddy field	Gundhi bug control	Tamil and Orissa	Mayahini *et al.*, 2020
43	Compost Preparation: cow dung + 10 kg Kochila seed powder + 25 kg kochila leaf	fruit and shoot borer control in the brinjal crop	Orissa	Das *et al*., 2020
44	Blending of cow urine and tobacco powder	diseases control of cucurbits, cowpea and lady finger	Jharkhand	Devendra *et al*., 2020
45	Application of cow dung slurry	rhinoceros beetle control	Tamil Nadu	Koodalingam *et al*., 2020
46	Application of dry mahua flower in the Soyabean crop	*Scalopendra spp*. (Gay gwalan) control	Madhya Pradesh	Ranjay *et al*., 2013
47	100-150 gm Asafoetida + 1 litre boiled water for 10-15 minutes, the boiled solution is poured in 40-50 litres water	Control of *Heliothis armigera* larvae and other small insects	Tamil Nadu and Madhya Pradesh farmer	Ranjay *et al*., 2013
48	dry tobacco leaves mixed with 5-6 litre boiled water	larvae of *Heliothis armigera* control	Orissa	Ranjay *et al*., 2013

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49	fresh leaves + buds Ipomea bushes is mixed 30-35 litres boiled water	*Heliothis armigera*, spotted bollworm and army worm control	Orissa	Ranjay *et al*., 2013
50	fresh neem leaves are boiled in 10 litres water	girdle beetle, bihar hairy caterpillar and other pests control	North-East, Orissa, Tamil Nadu and Bihar	Ranjay *et al*., 2013
51	Distribution of banana sucker, a black colocasia, wild turmeric and bamboo perch corner of the main field	rice pests control	Assam famer	Sarodee *et al*., 2020
52	Formulation of onion or garlic juice	grasshopper and leaf insects control	Madhya Pradesh Farmer	Shakrawar *et al*., 2018
53	Pourin of liquid lime in the Mandarin trunk	Gummosis disease and bark eating caterpillar, trunk borer control	North-East Farmer	Gohain *et al*., 2019

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Table 1.3: Indigenous knowledge Practices of farmers in farm machine & tools

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Field preparation- Nangal (plough), Jugal, Mwi, Khodal (digging hoe), Kontha (spua), Gandri or Dangan (leveller); seed sowing- Lauthi (digging stick), khopri, Mukha/Kho (mask); measuring harvested agricultural produce- Phalla (Weighing tool), Nareal Koltha (Coconut cover), Kurai Kowrai, Kurai Guhai; transporting agriculture commodities- Mosow giri (Bullock cart)	field preparation, seed sowing, measuring harvested agricultural produce, transporting agriculture commodities	Assam	Nirja and Luke, 2017
2	field preparation- Nangal (plough), Jugal, Mwi, Khodal (digging hoe), Kontha (spua), Gandri or Dangan (leveller)	field preparation	Assam	Sibisan, 2019
3	Post harvesting processings- Kashi (sickle), Sika (Knife), Sika-gobla (cleaver) for the crop harvesting; applies Baukha, Hukhen (grain separator), Royna, Sandanga (Sieve), Songri (winnower), Khada	Post harvesting processings	Assam	Nirja and Luke, 2017

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	(Basket made of Bamboo), Duli (grains store), Dingkhi (Grinder), Sundri (small kind of sieve), Khasa (rice store basket) , Gan/Gaihen (milling tools), Val/Ural (Milling tools), Don (Bamboo pan)			
4	Chili (water lifter)	field irrigation	Chhattisgarh	Nirja and Luke, 2017
5	land preparation- country plough (Kalappai); crop harvesting- sickle (karukkarival), knife (kambar kathi), Tamarind harvester (Puli kokki), lemon harvesting tool (Ezhumichai karandi); inter-cultural operations- weeder (aruguvetti), dry land weeder (cycle gundu), spade (mammutty); post harvesting of the grains- grain separater (kodun kol), wooden thresher (thattuppalagai), stone roller (uruttu kal), bamboo grinder (chekku), milling tool (ulakkkai); measuring the agricultural produce- Pukka, Marakaal, Naali; cleaning of the grains- (Sakkai piratti), bamboo pan (moonghil thattu).	land preparation, crop harvesting, inter-cultural operations, post harvesting of the grains, measuring the agricultural produce, cleaning of the grains	Tamil Nadu	Karthi keyan *et al*., 2008

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6	Application of plough (lungal), spader (plough), khurpa (khurpi), weeder rack (hashkini), spader (kodal/phaura), guity, sickle (kaste/daw), Daw (katruri), long handle dauli, Axe, sabal, hand stone mill, silpata. paddy spader, bamboo sieve, winnower, silo, bamboo basket, nanda, bhaungi, mugara (gila),pola, khalui, panki (boti)	crop production and management	eastern region	Bikash *et al*., 2015
7	Application of bullock drawn dhanti	control of weed populations	Orissa, Uttar Pradesh and Gujarat	Swain *et al*., 2020; Shamkuwar *et al*., 2020

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Table 1.4: Indigenous knowledge Practices of farmers in soil and water management

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	traditional micro-depression method in the Neem tree, teak tree and Mango	managing water, soil erosion control, improving soil properties	Tamil Nadu	Hiswaan *et al*., 2020
2	Rolu method	determining the rain water and collecting the rain water	Andhra Pradesh	Maruthi *et al*., 2020
3	Chaal (small water storage ponds)	drinking and irrigation purposes	Himachal Pradesh	Pradeep *et al*., 2020
4	Compound Mixture of wood ash, rice husk and cow dung cake	improving the property of the soil and moisture of the soil	Kerala, Madhya Pradesh, Punjab, Uttar Pradesh	Yadav *et al*., 2013 Balasubramanian *et al*., 2009
5	Grow of Aduthininapalai (*Aristolochia bracteolacia*)	evaluating soil water	South Indian	Ravisankar *et al*., 2017
6	Fruit trees-Kolingi (*Tephrosia purpurea*) cultivation	prevent soil erosion and moisture	Tamil Nadu	Ravisankar *et al*., 2017
7	liquid solution with ingredients of 10 kg Neem + 10 litre Cow urine + ½ kg asafetida waste	improving the soil productivity	Chhattisgarh, Kerala, Tamil Nadu and Uttar Pradesh	Ravisankar *et al*., 2017

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8	Cultivation of Vetiver (Khus grass)	managing land degradation and soil conservation	Karnataka, Andhra Pradesh and Kerala	Prakasa *et al*., 2015; Mishra *et al*., 2011
9	Cultivation and ploughs of Diancha (*Sesbania sp*.) snd Sun hemp (*Crotolaria juncea*)	improves water holding capacity and soil property	Mahrashtra, Kerala and Assam	Shobha *et al*., 2020
10	Cultivation of Poorvarasu (*Thespesia populnea*)	water loss from the soil	Kerala and Tamil Nadu	Binoo *et al*., 2016
11	Application of bagasse of sugarcane, leaves & branches of Indian gooseberry (*Phyllanthus distichus*)	improving saline soil	Tamil Nadu, Kerala and Karnataka	Binoo *et al*., 2016
12	Cultivation of *Tea quadrifolia* and *Cyanodan dactylon*	encourages better yield on the soil	Kerala and Hyderabad	Binoo *et al*., 2016
13	Cultivation of population of Pirandai (*Cissus quandrangularis*)	improving alkali soil	Tamil Nadu, Punjab, Haryana Himachal Pradesh and Maharashtra	Somasundaram *et al*., 2020
14	Cultivation of Diancha and Nut grass	improving alkali soil	South Indian and Uttar Pradesh	Somasundaram *et al*., 2020
15	Decomposed manure of cowdung, *Calotropis gigantea* leaves, neem cake powder	improving soil property	Tamil Nadu, Karnataka, Gujarat and Bihar	Krishan, 2005; Krishna *et al*., 2019

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16	water hyacinth as compost or burnt ash	progressing soil, water improvement, provides Potassium (K) nutrient in the soil	Bihar and North-East	Ganesh *et al*., 2011
17	Cultivation of green leaf manure such as Tephrosia purpurea, *Calotropis gigantea*, *Morinda tinctoria*, *Pongamia pinnata*, *Azadirachta indica*, *Thespesia populnea* and *Adathoda vasica*	crop growth and soil improvement	Rajasthan	Daagar and Teewari, 2016
18	Water catchment reservoirs- Tals, Khals, Chals and Rou	water collection	Uttarakhand Farmer	Anwesha and Pardeep, 2020
19	Bari system	water collection	Assam farmer	Anwesha and Pardeep, 2020
20	Saza Kuva open well	water collection	Rajasthan farmer	Anwesha and Pardeep, 2020
21	Terrace construction	terrace farming and land reformation	Sikkim farmer	Prabuddh *et al*., 2020

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Table 1.5: Indigenous knowledge Practices of farmers in animal husbandry

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Pseudostem banana to	cater pond fish	Dimapur, Assam, Kanyakumari and Goa	Bhalerao *et al*., 2015
2	500 gm maida + 500 gm behada powder + water after boiling	Foot and Mouth Disease control	Maharashtra	Choubey, 2005
3	Extract of peach leaves + fresh milk	lesion of mouth and hooves control	West Bengal, Rajasthan, Uttar Pradesh, Tamil Nadu, Jharkhand, Himachal Pradesh, Uttaranchal and Orrissa	Das *et al*., 2004
4	Paste of babool bark and Jamun bark	Foot and Mouth Disease control	Uttar Pradesh, Maharashtra and Orissa	Rajesh and Bharathi, 2012; Sarita *et al*., 2003
5	Paste of Bantulsi (*Ocimum gratissimum*) leaf + water	Khurha (FMD) disease control	Uttar Pradesh	Swarup and Pradhan, 2020
6	liquid medicine with stone apple (bael) + water	diarrhoea control	Uttaranchal	Mahesh, 2020
7	Mixing of pegion waste + jaggery	inducing oestrus cycle	Uttar Pradesh and Uttaranchal	Swarup and Mahesh, 2020

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8	Extracted juice of gurhal (urhul) flower treated orally in the goat	diarrhoea control	Uttaranchal	Dakshinkar and Vihan, 2020
9	Paste of Pojo (*Litsaea authapoly*)	diarrhoea and dehydration control	Jharkhand	Haque and Vihan, 2020
10	leaves of ridge gourd or ekdandi	wound of the animals	Himachal Pradesh	Varshney, 2020
11	Paste of 200-250 gm stem & leaf of Bhangariya (*Eclipta alba*) + 50-60 ml mustard oil	cattle, buffaloes and goat for cure blain control	Maharashtra	Jangde and Dhanan, 2020
12	Paste of 30 gm geru + 50 gm snail shell/sippi are boiled with castor oil + 20 gm Alua + 50 gm kudru/sahjam gum	bullocks or bulls for swelling control	Maharashtra and Uttar Pradesh	Swarup and Dhakate, 2020
13	Paste of kalajeera	*Haemrrhagic septicaemia* control	Maharashtra	Vihan, 2020
14	Hajore paste	recovering bone fracture	Jharkhand and Himachal Pradesh	Roy and Varshney, 2020
15	fish trapping- Ghuni, chero/kero, chokhia and atal; fish barrier-Aran bata/ Aran pata; catfish breeding - earthen rings/earthen pots	fish trapping, fish barrier, catfish breeding	West Bengal	Aparna *et al*., 2020
16	Channa gachua (Changmachh) local fish	curing Asthama and Body pain	Assam	Aparna *et al*., 2020

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17	oil of *Mystus vittatus*			
18	Lau Macha local fish cum vegetable (bottle gourd); murrels (*Channa spp*.), climbing perch (*Anabas testodeneous*) and cat fish (*Clarias batrachus*) and Bloch (*Heteroneutes fossilis*) in paddy field	weed population and soil loosening control	Tripura	Ratan and Dilip, 2013
19	10 gm Bark Aswatha (Banyon, ficuspa) + 10 gm Ada (Ginger) + 10 gm salt	managing bloat disease	West Bengal	Amitedu *et al*., 2004
20	Stem, leaves of Anantamul + honey	managing animal dysentery	Orissa and Gujarat	Bikram *et al*., 2012; Patel *et al*., 2016
21	100 gm tulsi leaves + 100 gm basak are boiled + water + honey	cold and cough control	Gujarat	Bikram *et al*., 2012; Patel *et al*., 2016
22	Preparation of glue with tamarind	strengthening of the nets	Hyderabad	Ram *et al*., 2013
23	Root of Babul (*Acacia arabica*) + mustard	arthritis control	Uttar Pradesh, Gujarat and Rajasthan	Ram *et al*., 2013
24	kala/Musa paradisiacal + sugar	oestrous cycle control	Uttar Pradesh, Gujarat and Rajasthan	Ram *et al*., 2013
25	cow dung slurry	managing euglena bloom	Hyderabad and Karnataka	Swamy *et al*., 2015

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26	200 gm termite mound soil + water	mastitits, poisonous bite of insects and mechanical injury control	Hyderabad and Karnataka	Swamy *et al*., 2015
27	Application of cashew shell oil, coal tar and sardine oil	boats and nets preservation	Bihar and Hyderabad	Sumit and Shivani, 2021
28	Application of saw dust and rice	fish preservation and transport	Hyderabad	Sumit and Shivani, 2021
29	Spices of mango pickles and neem leaves	bloat disease control	Bihar and Hyderabad	Sumit and Shivani, 2021
30	*Gardenia resinifera* Leaves and *Dendrophthoe falcata* seeds	constipation control	Bihar, Hyderabad and Orissa	Sumit and Shivani, 2021
31	whey milk, onion and custard apple leaves	excess grazing control	Bihar, Hyderabad and Maharashtra	Dipika *et al*., 2017
32	Vinegar	Tympany medication	Uttar Pradesh farmer	Gyan *et al*., 2016
33	Castor oil	Deworming diagnosis	Uttar Pradesh farmer	Gyan *et al*., 2016
34	Mustard oil	Body heat regulations	Uttar Pradesh farmer	Gyan *et al*., 2016
35	Turmeric lime paste	Sprain heal	Uttar Pradesh farmer	Gyan *et al*., 2016
36	Black pepper butter oil mixture	Pneumonia fever control	Uttar Pradesh farmer	Gyan *et al*., 2016
37	*Glyricidia* and roasted soaked tamarind seeds	Lactation improvement	Assam, Nagaland, Madhya Pradesh and Haryana Farmers	Deepandita *et al*., 2021

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38	seeds of subabul	milk secretion growth	Assam, Nagaland, Madhya Pradesh and Haryana Farmers	Deepandita *et al*., 2021
39	Liquid formulation product with Bottle gourd, fenugreek, coconut, black gram, palm jiggery, water	increase milk growth	Assam, Nagaland, Madhya Pradesh and Haryana Farmers	Deepandita *et al*., 2021
40	dried flowers of *Madhuca latifolia*	increase bullock work efficiency	Assam, Nagaland, Madhya Pradesh and Haryana Farmers	Deepandita *et al*., 2021
41	Powdered formulation with Pepper, jaggery and betel leaf	increase digestion rate	Assam, Nagaland, Madhya Pradesh and Haryana Farmers	Deepandita *et al*., 2021
42	Grinded *Iris kashmiriana* and jiggery	increase milk growth	Kashmir farmer	Shubeena *et al*., 2018

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Table 1.6: Indigenous knowledge Practices of farmers in medicinal & aromatic plants for diagnosis diseases

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Root part of *Acacia catechu* (khair)	asthama, bronchitis control	Northern Farmer	Chandra *et al*., 2006
2	Root part of *Aconitum ferox* wall. (Vatsnabh)	Rheumatism control	Northern Farmer	Chandra *et al*., 2006
3	Root part of *Aconitum heterophyllum* wall. (Atees)	fever, cough, piles and stomach control	Northern Farmer	Chandra *et al*., 2006
4	fruit & bark part of *Aegle marmelos* (L.) correa (Bell)	dysentery, diarrhoea, fever Health tonic	Northern Farmer	Chandra *et al*., 2006
5	bulb part of *Alpinia galalnga* (L.) wild. (Kulanjan)	Health tonic	Northern Farmer	Chandra *et al*., 2006
6	Bulb part of *Andrographis paniculata* (Burm. F.) wall.	malaria, liver & blood purifier	Northern Farmer	Chandra *et al*., 2006
7	whole part of *Aquillaria malaccensis* Lamk. (Agaru)	removing fish spine from throat	Northern Farmer	Chandra *et al*., 2006
8	whole part of *Artemisia maritima* L. (Kunja)	tonic, blood purifier, fever	Northern Farmer	Chandra *et al*., 2006

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9	root & stem of *Berberis aristata* DC. (Kingora)	diagnosing eye disease	Northern Farmer	Chandra *et al*., 2006
10	root of *Cassia augustifoila* Vahl (Senna)	rheumatism control	Northern Farmer	Chandra *et al*., 2006
11	tuber of *Cholorphytum tuberosum* Bak. (Safed musli)	Leucorrhea, sexual tonic control	Northern Farmer	Chandra *et al*., 2006
12	root of *Coleus barbatus* Benth. (Patharchur)	tonic and blood pressure control	Northern Farmer	Chandra *et al*., 2006
13	resin & bark of C*ammiphora wightii* (Arn.) Bhandari	Asthma, typhoid control	Northern Farmer	Chandra *et al*., 2006
14	root of *Curculigo orchioides* haerten (Kali musli)	asthma, dysentery, tonic	Northern Farmer	Chandra *et al*., 2006
15	Rhizome of *Curcuma zedoaria* (christ) Rosc.	control of jaundice, blood pressure	Northern Farmer	Chandra *et al*., 2006
16	Seed & fruit of *Embelia ribes* Burm. f. (Jheum)	control of skin diseases, leprosy	Northern Farmer	Chandra *et al*., 2006
17	fruit of *Garcinia indica* choisy (Kokam)	skin disease control	Northern Farmer	Chandra *et al*., 2006
18	rhizome of *Gloriosa superb* L. (Kalibari)	snake bite, leprosy control	Northern Farmer	Chandra *et al*., 2006

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

19	root & leaf of *Gymnema sylvestre* (Retz.) (Gudmar)	Gastric disorder, eye disease	Northern Farmer	Chandra *et al*., 2006
20	root of *Hemidesmus indicus* (L.) Br.	curing cough, hypertension, dysentery	Northern Farmer	Chandra *et al*., 2006
21	rhizome of *Myrica esculenta* Ham. exdon (Kaphal)	curing bronchitis, blood purifier, hysteria	Northern Farmer	Chandra *et al*., 2006
22	fruit & seed of *Nelumbo nucifera* barten (kamal phool)	curing chlorea, diarrhoea	Northern Farmer	Chandra *et al*., 2006
23	leaf & seed of *Ocimum sanctum* L.	treating fever, vomiting, liver & blood purifier	Northern Farmer	Chandra *et al*., 2006
24	leaf & seed of *Phyllanthus emblica* L. (amla)	curing fever, vomiting, liver, blood purifier	Northern Farmer	Chandra *et al*., 2006
25	root of *Picrorhiza kurrooa* Benth. (Katuki)	curing Headache, fever, dysentery	Northern Farmer	Chandra *et al*., 2006
26	fruit of *Pistacacia chinenesis* Bunge (Kakadshingi)	curing cholera, fever, cough	Northern Farmer	Chandra *et al*., 2006
27	Root of *Piper longum* L.	curing indigestion, child birth, dysentery	Northern Farmer	Chandra *et al*., 2006
28	Root of *Pistacacia chinensis* Bunge (Sarapagandha)	curing malaria fever, snake bite	Northern Farmer	Chandra *et al*., 2006

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

29	wood of *Santallum album* (chandan)	curing dysentery and skin disease	Northern Farmer	Chandra *et al*., 2006
30	bark & leaf of *Saraca asoca* (Ashok)	Heart disorder	Northern Farmer	Chandra *et al*., 2006
31	root of *Saussurea costus* (Falc.) Lipsch. (Kut)	dysentery, asthama, ulcer	Northern Farmer	Chandra *et al*., 2006
32	whole part of *Smilex sp*. (Chopchini)	menstrual complain & small pox	Northern Farmer	Chandra *et al*., 2006
33	whole plant of *Solanum nigrum* (Giloe)	curing jaundice, bone fracture	Northern Farmer	Chandra *et al*., 2006
34	root and leaf of *Valeriana jatamansi* (Tagar)	curing epilepsy, urinary complain	Northern Farmer	Chandra *et al*., 2006
35	root & leaf of *Withiana somnifera* (Ashwagandha)	curing eye, asthama, cough	Northern Farmer	Chandra *et al*., 2006
36	bark & latex of *Wrightia tinctoria* (Indra java)	curing toothache, piles, dysentery	Northern Farmer	Chandra *et al*., 2006
37	leaves of *Andrographis panicular*	curing dog bite	Tripura	Maria *et al*., 2017
38	root of *Phylogacanthus thyrsiflorus*	curing cold, cough, asthama	Tripura	Maria *et al*., 2017
39	bark & root of *Achyranthes aspera*	toothache	Tripura	Maria *et al*., 2017

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

40	whole plant of *Centella asiatica* L.	tooth problem	Tripura	Maria *et al*., 2017
41	latex & shoot of *Alstonia scholaris* L.	curing mother milk	Tripura	Maria *et al*., 2017
42	leaves of *Holarrhena antidysentria*	curing dysentery, diarrhoea, anthelmintic	Tripura	Maria *et al*., 2017
43	leaves & latex of *Homalonema aromatic*	curing snake bite	Tripura	Maria *et al*., 2017
44	leaves of *Ageratum conyzoides*	curing wounds, cut	Tripura	Maria *et al*., 2017
45	leaves of *Enydra fluctuans*	treating bleeding	Tripura	Maria *et al*., 2017
46	whole plant of *Spilanthes paniculata*	treating gastric, stomach problem, throat, diabetes	Tripura	Maria *et al*., 2017
47	leaves of *Kalanchoe pinnata*	curing dysentery	Tripura	Maria *et al*., 2017
48	leaves of *Coccinia grandis*	curing diabetes	Tripura	Maria *et al*., 2017
49	leaves & fruits of *Momordica cacharantia*	curing hand pimples, foot pimples	Tripura	Maria *et al*., 2017
50	leaves of *Acacia concinna*	treating diabetes and body pain	Tripura	Maria *et al*., 2017
51	leaves of *Cajanus cajan*	treating jaundice	Tripura	Maria *et al*., 2017
52	fruits of *Cassia fistula*	curing laxative	Tripura	Maria *et al*., 2017

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53	leaves of *Cassia accidentalis*	treating skin disease	Tripura	Maria *et al*., 2017
54	leaves & root of *Mimosa pudica*	curing ring worm, piles	Tripura	Maria *et al*., 2017
55	fruits of *Parkia javanica* uti	curing gastric problem	Tripura	Maria *et al*., 2017
56	leaves & flower of *Lecuas aspera*	curing pain, gastric problem, swelling	Tripura	Maria *et al*., 2017
57	leaves & bark of *Ocimum basilicum*	curing gastric problem, stomach problem	Tripura	Maria *et al*., 2017
58	leaves of *Ocimum Sanctum* L.	treating cough, cold	Tripura	Maria *et al*., 2017
59	leaves of *Premna sp.*	treating ant bite	Tripura	Maria *et al*., 2017
60	bark & root of *Litsea glutinosa*	curing muscle pain, bone fracture	Tripura	Maria *et al*., 2017
61	root, leaves & bud of *Hibiscus rosa sinensis*	treating irregular menstruation	Tripura	Maria *et al*., 2017
62	leaves of *Sterculli aviliosa*	treating menstruation pain	Tripura	Maria *et al*., 2017
63	leaves & fruits of *Moringa oleifera*	treating cooling effect	Tripura	Maria *et al*., 2017
64	leaves of *Psidium guajava*	for treating diarrhoea, dysentery, piles, vomiting	Tripura	Maria *et al*., 2017

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

65	leaves of *Nyctanthes arbor-tristis*	curing asthama, stomach disorder	Tripura	Maria *et al*., 2017
66	fruits & leaves of *Phyllanthus acidus*	treating chicken pox	Tripura	Maria *et al*., 2017
67	leaves of *Scoparia daclis*	treating body pain	Tripura	Maria *et al*., 2017
68	whole plant of *Cyanodon dactylon*	treating toothache	Tripura	Maria *et al*., 2017
69	rhizome of *Drynaria quercifolia*	treating swelling	Tripura	Maria *et al*., 2017
70	leaves & fruits of *Ageles marmelos*	curing high fever, malaria	Tripura	Maria *et al*., 2017
71	root of *Murraya paniculata*	curing toothache	Tripura	Maria *et al*., 2017
72	fruits of *Flacourita jangomas*	curing dysentery, diarrhoea	Tripura	Maria *et al*., 2017
73	rhizome of *Aloe barbadensis*	curing cold, cough	Tripura	Maria *et al*., 2017
74	rhizome of *Curcuma zeodaria*	curing stomach, urinary disorder	Tripura	Maria *et al*., 2017
75	*Aconitum balfourii* (meetha/Bhngwa)	curing diaphoretic, diuretic, analgesic, anti-inflammatory, anit-pyretic, vermifuge	Uttarakhand	Ankit *et al*., 2017

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76	*Aconitum heterophyllum* (Atees)	treating anti-inflammatory, anti-pyretic, anti-bacterial, anthelminthic	Uttarakhand	Ankit *et al*., 2017
77	*Ajuga parviflora* (Neel Kanthi)	curing hypertension, malaria, pneumonia, edema, anit-fungal, hypoglycemic, anit-microbial agents	Uttarakhand	Ankit *et al*., 2017
78	*Alllium cepa* (Pyaj)	curing anti-tumour, anti-diabeteic, anti-allergic and anti –mollusicidal	Uttarakhand	Ankit *et al*., 2017
79	*Allium sativum* (Lehsum)	burn and cut	Uttarakhand	Ankit *et al*., 2017
80	*Allium wallichii*	treating gastric	Uttarakhand	Ankit *et al*., 2017
81	*Angelica glauca* Edgew (choru)	treating gastric	Uttarakhand	Ankit *et al*., 2017
82	*Artemisia nilagirica* (kunja)	cut & wounds	Uttarakhand	Ankit *et al*., 2017
83	*Asparagus filicinus* (Jhirna)	treating weakness	Uttarakhand	Ankit *et al*., 2017
84	*Berberis aristata* (kingod)	curing eye ailments	Uttarakhand	Ankit *et al*., 2017
85	*Bergenia stracheyi* (Pashanbhed)	curing stone problem	Uttarakhand	Ankit *et al*., 2017
86	*Centella asiatica* (Brahmi)	treating coolant disease	Uttarakhand	Ankit *et al*., 2017

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87	*Cinnamomum tamla* (tejpat)	curing blood pressure	Uttarakhand	Ankit *et al*., 2017
88	*Cirisium wallichi* (kanjelu)	treating fever	Uttarakhand	Ankit *et al*., 2017
89	*Cucumis sativus* (kakdi)	curing diuretic disease	Uttarakhand	Ankit *et al*., 2017
90	*Cucurma longa* (Haldu)	treating cut, wound	Uttarakhand	Ankit *et al*., 2017
91	*Dioscorea bulbifera* (Tairu)	treating coolant disease	Uttarakhand	Ankit *et al*., 2017
92	*Eupatorium adenophorum* (Basya)	treating cut and wound	Uttarakhand	Ankit *et al*., 2017
93	*Girardinia diversifolia* (kandali)	curing fever	Uttarakhand	Ankit *et al*., 2017
94	*Hippophae salicifolia* (Amesh)	treating coolant	Uttarakhand	Ankit *et al*., 2017
95	*Juglans regia* (Akhrot)	curing skin disease	Uttarakhand	Ankit *et al*., 2017
96	*Jurinea macrocephala* (Biskhanada)	curing fever	Uttarakhand	Ankit *et al*., 2017
97	*Macrotyloma uniflorum* (gahat)	curing stone disease	Uttarakhand	Ankit *et al*., 2017
98	*Megacarpaea polynadra* (Barmolu)	treating gastric problem	Uttarakhand	Ankit *et al*., 2017
99	*Mentha pipertia* (Pudina)	curing coolant disease	Uttarakhand	Ankit *et al*., 2017
100	*Mirabilis jalapa*	curing cut & wound	Uttarakhand	Ankit *et al*., 2017
101	*Nardostachys jatamansi* (Maasi)	for treating jaundice	Uttarakhand	Ankit *et al*., 2017

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

102	*Ocimum corniculata* (Almodu)	treating boils	Uttarakhand	Ankit *et al*., 2017
103	*Paeoni emodi* (chandra)	treating fever	Uttarakhand	Ankit *et al*., 2017
104	*Picrorhiza kurrooa* (Kadwi)	treating fever	Uttarakhand	Ankit *et al*., 2017
105	*Polygonatum verticillatum* (Mahamaida/salampanja)	curing fever	Uttarakhand	Ankit *et al*., 2017
106	*Potentilla lineata* (Bajradanti)	treating Anaemia	Uttarakhand	Ankit *et al*., 2017
107	*Rheum moorcroftianum* (Dolu)	curing injury, cut and wound	Uttarakhand	Ankit *et al*., 2017
108	*Rhododendron campanulatum* (Syamru)	curing skin disease	Uttarakhand	Ankit *et al*., 2017
109	*Rumex nepalensis* (khuldya)	curing pneumonia, cut, wound	Uttarakhand	Ankit *et al*., 2017
110	*Saussurea costus* (kuth)	treating skin disease	Uttarakhand	Ankit *et al*., 2017
111	*Selinum vaginatum* (bhutkesh)	curing coolant disease	Uttarakhand	Ankit *et al*., 2017
112	*Swertia chiraytia* (chiraitu)	curing fever, stomach, ache	Uttarakhand	Ankit *et al*., 2017
113	*Tagetes erecta* (gainda)	curing ear ache	Uttarakhand	Ankit *et al*., 2017
114	*Taxus wallichiana* (thuner)	treating high blood pressure	Uttarakhand	Ankit *et al*., 2017

115	*Tinospora sinesis* (giloe)	curing fever, stomach, ache	Uttarakhand	Ankit *et al*., 2017
116	*Utrica dioca* (kundali)	treating anaemia, weakness	Uttarakhand	Ankit *et al*., 2017
117	*Zanthoxylum armatum* (Timru)	curing teeth, toothache	Uttarakhand	Ankit *et al*., 2017
118	Habb-e-Asgand unani	Wajalal mafasil (*Rheumatoid arthritis*) (gaathia)	Aligarh	Verma *et al*., 2021
119	Powdered form of root of *Anacyclus pyrethrum*, *Withania somnifera*, *Chlorophytum borivilianum*, *Asparagus racemosus* and tuber of *Pueraria tuberosa*	stimulates sexual hormone in male gender	Varanasi	Kumar *et al*., 2021
120	liquid of pseudostem of *Ensete glaucum* (roxb.) cheesman	diagnosing diarrhoea	Meghalaya	Joga *et al*., 2020
121	*Frangipani, periwinkle, turkey berry, Night shade, Indian trumpet flower and Giloy*	asthma, bronchitis, cough, sinusitis, diabetes, malaria, typhoid and jaundice controls	Adi community, Arunachal Pradesh	Ranjay *et al*., 2020
122	*Juniperus polycarpus* C. Koch (Himalayan pencil cedar)	monastery constructions, increases preparations, fuelwood and fodder crops	Himalayan cold desert region of Ladakh	Dorjey and Maurya, 2020

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123	*Bidelus pilosa, Cedrus deodara*	skin disease treatment	Uttarakhand	Aakash *et al*., 2021
124	*Eclipta alba, Mallotus philippensis, Boehmeria rugulosa, Celtis australis*	constipation disorder, lier disorder	Uttarakhand	Aakash *et al*., 2021
125	*Aretmisia annua*	cosmetic product development	Uttarakhand	Aakash *et al*., 2021
126	*Parthenium hysterophorus*	insect bites, infertility problem	Uttarakhand	Aakash *et al*., 2021
127	*Chenopodium album, Berginia ciliate*	curing stone problem	Uttarakhand	Aakash *et al*., 2021
128	*Xanthium stramonium*	curing tooth problem	Uttarakhand	Aakash *et al*., 2021
129	*Boerhavia diffusa, Sterculia villosa*	curing blood dysentery	Uttarakhand	Aakash *et al*., 2021
130	*Helicteres isora, Artemisia japonica*	curing epilepsy	Uttarakhand	Aakash *et al*., 2021
131	*Betula utilis, Achyranthus aspera*	curing muscular pain & swelling	Uttarakhand	Aakash *et al*., 2021
132	*Bergenia ciliata, Colebrookia oppositifolia, Rumex hastus, Ageratum conyzoides, Brassica campestris*	cut and wound treatment	Uttarakhand	Aakash *et al*., 2021

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 June 2022 doi:10.20944/preprints202206.0071.v1

133	*Fagopyrum esculatum*	curing urinary disorder, headache and menstrual disorder	Uttarakhand	Aakash *et al*., 2021
134	*Amaranthus paniculatus*	destroying worms in children	Uttarakhand	Aakash *et al*., 2021
135	*Cyanodon dactylon*, *Syzgium cumini*, *Artimisia maritime*	curing stomach problem	Uttarakhand	Aakash *et al*., 2021
136	*Bombax ceiba*	curing piles disease	Uttarakhand	Aakash *et al*., 2021
137	*Treminalia chebula*	curing indigestion problem	Uttarakhand	Aakash *et al*., 2021
138	*Litsea chinenesis*	curing fractured bone	Uttarakhand	Aakash *et al*., 2021
139	*Amaranthus spinosus*	curing scorpion bite	Uttarakhand	Aakash *et al*., 2021
140	*Centella asiatica*	memory enrichment	Uttarakhand	Aakash *et al*., 2021
141	*Discorea bulbifera* L.	curing cancer, HIV, anti-inflammatory, anti-microbial, cardioprotective and anti-hyperthyroid activities	Dongria Kandha tribes	Parida and Sarangi, 2020
142	*Ocimum tenuiflorum*, *Ocimum sanctum* (holy basil/tulsi)	herpes virus, foot and mouth disease virus and	Uttar Pradesh	Goel and Bhatia, 2022

		castle disease virus control		
143	*Aconitum heterophyllum* wall. (Patis, Aconite, Dhar buti, Attees or Bis Mohra)	intestinal worms, diarrhoea, dysentery, high fever and anti-rheumatic	Jammu	Bagal *et al*., 2022
144	*Viola odorata* (Bnafsaha, wild violet, sweet violet)	fever, cold, cough, hypertension, muscle spasms, parasitic worms, malaria controls	Jammu	Bagal *et al*., 2022
145	*Valeriana jatamansi* (mush khala, jatamansi, balchhari, mansi, nihani)	treating eye, blood liver problem, hysteria, nervous andurinal stress	Jammu	Bagal *et al*., 2022
146	*Picrorhiza kurroa* (Kaud, kaur, kutki)	fever, cold cough, hypertension, muscle spasms, parasitic worms and malaria treatments	Jammu	Bagal *et al*., 2022
147	*Bergenia ligulata* (patharchoor, pashanbeda)	healing of longevity, anti-viral, analgesiscs, ascites, hypoglycemic, anti-arthritic and anti-ageing	Jammu	Manosi *et al*., 2022
148	*Cryptolepis buchananii*, *Eucalyptus citriodora*, *Ligustrum japonicum*,	skin infection treatment	Solan district farmer, Himachal Pradesh	Kumar *et al*., 2021

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	Pinus roxburghii, *Rosa alba*, *Ziziphus nummularia* and *Sonchus oleraceus*			
149	*Rhododendron arboreum*, *Zanthoxylum armatum*, *Viola canescens*, *Quercus leucotrichophora*, *Rubus ellipticus*, *Punica granatum*, *Ocimum sanctum*, *Morus nigra*, *Mentha arvensis*, *Justicia adhatoda*, *Ficus benghalensis*, *Eriobotrya japonica*, *Debregeasia longifolia*, *Cissampelos pareira*, *Datura innoxia*, *Eucalyptus citriodora*, *Cynodon dactylon*, *Colebrookea oppositifolia* and *Cannabis sativa*	diarrhea, diabetes, dysentery, cough, cold and fever treatments	Solan district farmer, Himachal Pradesh	Kumar *et al*., 2021

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Table 1.7: Indigenous knowledge Practices of farmers in stored grain pests' management

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Construction of godowns with straw, leaves and the godowns mounted with cow dung	grains storage	Uttar Pradesh and Tamil Nadu	Vishal *et al*., 2020
2	Mixing of 200 gm of common salt + red gram/Arhar	controlling stored grains pests	Tamil Nadu	Karthikeyan *et al*., 2009
3	Neem oil blends with coconut oil/castor oil (1:1)	storage and pests control	Tamil Nadu	Karthikeyan *et al*., 2009
4	5 litre groundnut oil + ¼ kg tamarind	prevents oil spillage	Tamil Nadu	Karthikeyan *et al*., 2009
5	neem leaves, thumbai and any strong odour leaves (Kaddi patta, tulsi, lemon grass etc) + ragi grains	controlling lesser grain borer, saw toothed beetle and flat grain borer	Tamil Nadu, Kerala and Karnataka	Shaila and Nafeesa, 2021
6	Mixing of pegion pea seed with horse gram seed dust	assimilates excess moisture and encourages long term storage	Tamil Nadu, Kerala, Telangana and Karnataka	Shaila and Nafeesa, 2021
7	Construction of godowns/granary room with brick and wooden boards	controlling rice moth and restrict moisture of the grains	Tamil Nadu, Uttar Pradesh and Mahrashtra	Parimala *et al*., 2013

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8	Jute bags: 1 gm camphor/5 kg grains	short term grains storage	Manipur and Tamil Nadu	Adesina *et al*., 2019
9	10 gm lime per kg grains in jute gunny bags	1 year grains storage	Karnataka, Assam and Kerala	Bhavani and Ningdalli, 2015
10	Mixing of gingelly seed with 100 gm paddy	3 months gingelly seed storage, controlling Indian meal moth (*Plodia interpunctella*)	Karnataka and Tamil Nadu	Bhavani and Ningdalli, 2015
11	Mixing of 1 kg pulse seed in 20 ml of neem oil	long term storage & weevils, red flour beetles, long headed flour beetle and fig moth controls	Tamil Nadu	Marziyeh *et al*., 2017
12	Application of Pungam leaves in paddy storage in the gunny bags	Angoumois grain moth, rice weevils controls and long term storage	Gujarat and Orissa	Sahu *et al*., 2022
13	paddy husk upto 5 cm in top portion of the earthen pot	seed damage control and pest control	North-East, Tamil Nadu, Punjab and Haryana	Bordoloi *et al*., 2017; Singh, 2018
14	2 kg paddy seed + 1 kg salt + 10 litre water	releasing chaffy seed	Tamil Nadu, Kerala, Orissa and North-East	Bordoloi *et al*., 2017; Singh, 2018
15	Pouring of paddy seed in the water overnight	seed germination	North-Eastern and Karnataka	Rakesh *et al*., 2013; Ambika *et al*., 2014

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16	1 kg sorghum seed dissolves in 100 gm dry cow dung powder + 250 ml cow urine	improving seed germination	North-Eastern, Tamil Nadu, Madhya Pradesh and Karnataka	Rakesh *et al*., 2013; Ambika *et al*., 2014
17	pegion pea seed with dry powder bitter gourd and drum stick seed for 3-6 months	controlling insect-pests	North-Eastern, Telangana and Karnataka	Rakesh *et al*., 2013; Ambika *et al*., 2014
18	10 kg green gram seed with 250 gm chilli powder + 1 kg ragi/finger millet flour + paddy husk	prevents attack of storage pests	North-Eastern and Karnataka	Rakesh *et al*., 2013; Ambika *et al*., 2014
19	Dry cow dung with ghee + honey	seed treatment	North-Eastern, Uttar Pradesh, Himachal Pradesh and Kerala	SCERT, 2016
20	Treatment pegion pea seed with dry pongamia leaf	controlling storage pests	Uttar Pradesh, Karnataka and Orissa	Usharani *et al*., 2019; Jyoti *et al*., 2020
21	pegion pea seed with dry guntur chilli powder and neem leaf powder	controlling insect-pests and seed senescence	North-Eastern, Kerala, Andhra Pradesh and Karnataka	Usharani *et al*., 2019; Jyoti *et al*., 2020
22	Either mint leaves powder or sweet flag root powder	inhibiting insect-pests	Kerala, Andhra Pradesh and Karnataka	Usharani *et al*., 2019; Jyoti *et al*., 2020

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23	chilli seed in the gunny bag and kept in a hot water for a day	improves seed availability and vigour	North-Eastern, Kerala and Karnataka	Usharani *et al*., 2019; Jyoti *et al*., 2020
24	Blending of citronella leaf oil/cotton seed oil/ soyabean oil/ castor seed oil in 100 kg chickpea seed	controlling insect pest and microbes such as *Alternaria sp*. or *Fusarium sp*	Orissa, Telangana and Maharashtra farmer	Ruparao *et al*., 2018
25	Dried leaves of neem in the grains warehouse	stop attack of stored grains pest	Punjab, Haryana, Rajasthan, Uttar Pradesh and Karnataka	Yallappa *et al*., 2012
26	dried leaves of notchi (*Vitex negundo)*	stops the attack of stored pests	Tamil Nadu, Madhya Pradesh, Assam, Uttar Pradesh and Uttarakhand	Shivankar *et al*., 2006
27	1 kg Vasambu (*Acorus calamus*) in 50 kg grains	forbids invasion of stored pests and enhances 1 year storage period	Tamil Nadu	Kathirvelu *et al*., 2019
28	Exposure stored pulse grain in open sunlight at 20 °C	*Callosobruchus chinensis* eggs and grubs control	Manipur Farmer	Adesina *et al*., 2019

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29	Custard apple seed powder in Pulse grains	bruchid adult and eggs control	Karnataka Farmer	Prakash *et al*., 2016

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Table 1.8: Indigenous knowledge Practices of farmers in weed management

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	Cultivation of jethi rice, finger millet, black soyabean, horse gram	weed control and moisture conservation	Uttarakhand and Karnataka	Nautiyal *et al*., 2017; Reddy *et al*., 2008
2	Dispersion and Burning of dry leaves of pine into the field	weed control	Jammu and Kashmir, Haryana, Himachal Pradesh, Uttar Pradesh, parts of Sikkim, West Bengal and Arunachal Pradesh	Patel *et al*., 2015
3	Application of Common salt (NaCl)	*A. conyzoides* and *Crassocephalum creidioides* control	Meghalaya and Mahrashtra	Patel *et al*., 2015
4	Cultivation of green leaf manure such as Diancha (*Sesbania sp*.), Kolingi (*Tephrosia purpurea*)	weed control	North-Eastern, Orissa, West Bengal, Tamil Nadu and Karnataka	Ramyajit and Saumi, 2019
5	200 gm Salt + 1 litre water	controlling Congress weed (*Parthenium hysterophorus*)	Tamil Nadu	Surinder *et al*., 2018

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6	50 kg Neem cake in the field	controlling Nut grass	Tamil Nadu, Kerala, Himachal Pradesh, Assam, Meghalaya and Kerala	Surinder *et al*., 2018

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Table 1.9: Indigenous knowledge Practices of farmers in value added food product

S.No.	Indigenous Traditional Knowledge (ITK)	Cause	State	References
1	wild type mesta and Roselle (*Hibiscus subdoriffa*)	Preparation of indigenous pickle and Chatni	North-East	Jiraporn, 2018
2	Composition of Sangyod rice flour + wheat flour	Preparation of domestic wheat bread	Phatthalung Province	Jiraporn, 2018
3	Fermented food- gundruk, sinki, anishi, Bhatooru, Marchu and Chilra, Kienma, Tungrymbai, Mesu, Soibum, Ngari, Hentak, Kadi, Churpa/Churpi and Nadu ghanti, Jann/Jaan and Daru	Fermented vegetable food, Fermented pulse food, Fermented Bamboo food, Fermented fish food, Fermented Milk food, Fermented alcoholic beverage	Arunachal Pradesh	Nazish, 2013
4	Edible Bamboo species- *Bambusa Cephalostachyum*, *Chimono Bambusa*, *Dendrocalamus sp*. and *Melocanna sp*. for culinary and product uses, bamboo shoot curry- (Usoi Ooti), Bamboo shoot salad- (Usoi Kangsu), Bamboo shoot chutney- (Soibum), Fermeneted shoot curry- (Soibum Thonga), Fried Bamboo shoot- (Laiwa	culinary and product uses, bamboo shoot curry, Bamboo shoot salad, Bamboo shoot chutney, Fermeneted shoot curry, Boiled Bamboo shoot, Bamboo shoot pickles	Manipur	Premlata *et al*., 2020

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	Kanghou), Boiled Bamboo shoot-(Usoi Chamfat), Bamboo shoot pickles- (Usoi aachar			
5	wild edible fruit such as *Cotoneaster* sp., *Fragaria* sp., *Malus* sp., *Prunus* sp., *Rosa* sp., *Sorbaria* sp. and *Sorbus* sp.	preparation of local beverage (Aygar), tobacco pickles, chutney oil, furniture and agriculture tools & implements	Bhotia community of Uttarakhand	Badal *et al*., 2022
7	Galho rice either with wild leaves; mixtures of Salt, garlic, potatoes, tomatoes, dry fish & fermented soyabean and *Perilla frustescens* Seeds	Diet	Nagaland community	Singh and Teron, 2017
8	Preparation of Tathu chutney with chilli paste, leaves and dry meat or fermented fish	Diet	Nagaland community	Singh and Teron, 2017
9	Preparation of Modi with a piece of Mithun, beef or pork, ginger, garlic, onion, chilli, and salts	Diet	Nagaland community	Singh and Teron, 2017
10	Preparation of Ghabe food with boiling of leaves with addition of spices, chilli, fermented Soyabean or dry fish	Diet	Nagaland community	Singh and Teron, 2017

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11	Preparation of Galkemeluo food with boiling of wild leaves with bamboo shoot, garlic, tomato, potato, dry or smoked meat, dry fish, fermented soyabean, *Zanthoxylum rhetsa* and *Zanthoxylum armatum*	Diet	Nagaland community	Singh and Teron, 2017
12	Preparation of fermented pig fat with chopped pieces of inner abdominal portion of pig	Diet	Mizoram community	Lalthanpuii *et al*., 2015
13	Oil extraction with fermented Seasame	Diet	Mizoram community	Lalthanpuii *et al*., 2015
14	Preparation of Sun drying leaves of *Hibiscus sabdariffa* Linn either with seasonal vegetables and fish, chicken, beef, pork	Diet	Mizoram community	Lalthanpuii *et al*., 2015
15	Preparation of smoked meat Wild animals such as barking deer, sambar deer wild boar, macaque, birds, squirrels and rodents with thick pointed Bamboo sticks	Diet	Mizoram community	Lalthanpuii *et al*., 2015
16	Preparation of Tunateinzi food with ingredient of rice flour and sugar	Diet	Manipur tribe	Thangjam *et al*., 2018

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17	Preparation of Lengchiphon food with ingredient of rice flour and liquid sugar	Diet	Manipur tribe	Thangjam *et al*., 2018
18	Preparation of Ganang Tamdui food with fermented mustard leaves and banana leaves	Diet	Manipur and Nagaland Tribe	Thangjam *et al*., 2018
19	Preparation of Gundruk food with dried mustard leaves	Diet	Manipur, Mizoram, Sikkim and Darjeeling Tribe	Thangjam *et al*., 2018
20	Preparation of Bi-kang food with boiling and drying of *Colocasia*	Diet	Manipur tribe	Thangjam *et al*., 2018
21	Preparation of fermented Soyabean	Diet	Manipur, Mizoram, Sikkim and Darjeeling community	Thangjam *et al*., 2018
22	Preparation of Gankhiang-khui food with alkaline fermented seeds of *Hibiscus canabinus*	Diet	Manipur community	Thangjam *et al*., 2018
23	Preparation of food with *Auricularia auriculari*, *Schizophyllum commune* and *Lentinula edodes* wild mushrooms	Diet	Manipur community	Thangjam *et al*., 2018

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Fig. 1: Practices of Indigenous Agriculture Informations (IAI) in the rural community

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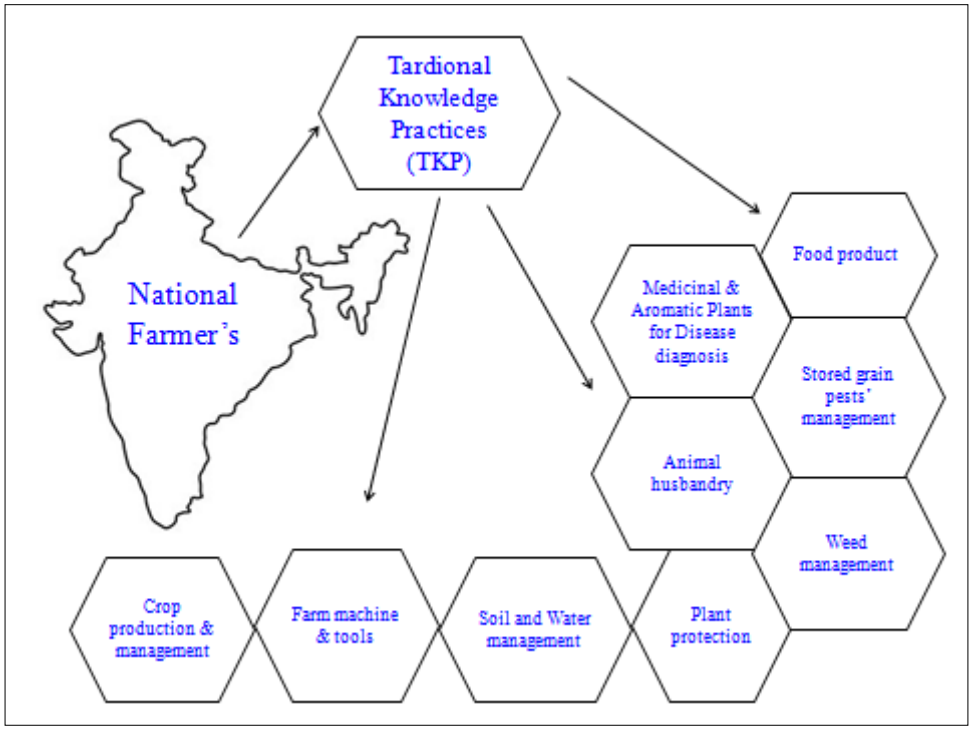

Fig. 2: Farmer's practices Traditional Agriculture Knowledge (TAK) in India