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CONTENTS

Studies on Indigenous Agricultural Technical Knowledge prevalent among the farmers of Assam for the management of common pests and diseases in major crops

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ABSTRACT: A study on IATKs commonly practiced related to the management of common pests and diseases of major crops followed by the farmers of Jorhat district, Assam, was under taken. The aim of the study was to create a database on common IATKs, to determine the effectiveness of identified IATKs as perceived by farmers and also to determine the scientific rationality of the identified IATKs as perceived by Agricultural Scientists. Both pre-tested structured schedules as well as questionnaire were used to collect data from field level and institutional level, respectively. It revealed that in rice, studied, 32 number of IATKs were targeted against major insect pests like stem borer, rice hispa, gundhi-bug, case-worm, rodents and birds and only 3 numbers were found to be used against the diseases like brown spot, blast and bacterial leaf blight. In case of stored grains pests of rice and pulse, only three numbers of IATK were predominantly used. Whereas in potato, brinjal, cucurbits, tomato, chilli and cole crops 4, 3, 3, 2, 1 and 1 numbers of practices, respectively were recorded to be used against different common pest and diseases.

Key words: Effectiveness, IATK, pest and disease management, scientific rationality

Indigenous knowledge (IK) is the knowledge that people in a given community have developed over time, and continues to develop which is based on experience, often tested over centuries of use, adapted to local culture and environment. It is considered as the basis for self-sufficiency and self-determination for the farmers because they are familiar with indigenous practices and technologies. They can understand, handle, and maintain them better than introduced improved practices and technologies. The terms traditional knowledge (TK), indigenous knowledge (IK), and local knowledge (Lk) generally refer to knowledge systems embedded in the cultural traditions of regional, indigenous, or local communities. Traditional knowledge includes types of knowledge about traditional technologies of subsistence (e.g. tools and techniques for hunting or agriculture), midwifery, ethno botany and ecological knowledge, traditional medicine, celestial navigation, ethno astronomy, the climate, and others. These kinds of knowledge, crucial for subsistence and survival, are generally based on accumulations of empirical observation and interactions with the environment (Atte, 1989).

IATKs are gaining importance because they have minimum risk factor, heavy reliance on genetic and physical diversity, exploitation of optimal utility of local resources, environmentally healthy, readily available and easily understandable, relevant to local farming system and adaptable to meet multipurpose community needs, based on the cultural values of the community (Gupta *et al.*, 1994). IK draws on local resources and help people in becoming less dependent on outside supplies, which can be costly, scarce and available irregularly (Langill and Landon,1998). Since the last decade, the importance of indigenous agricultural technical knowledge (IATK) commonly practiced by the farming community to minimise crop losses due to several biotic stresses have been realized by a growing number of agricultural scientists. The potentiality of IATKs has been recognised both in research and extension wings of agricultural science. These can form a knowledge base for researchers and extension personnel in planning their research strategy and experimental procedure in order to generate and demonstrate appropriate farm technologies (Langill and Landon, 1998). In-depth studies on different IATKs, revealing the understanding of their scientific basis may be considered as useful stimuli to develop economically viable and socially acceptable practices for the farmers. With these view, it was felt that it will be worthwhile to study indigenous pest and disease management practices in different crops for their effectiveness and scientific rationality.

MATERIALS AND METHODS

A multistage purposive-cum-random sampling design was followed for selection of farmer respondents to identify the indigenous pest and disease management practices and

their effectiveness as perceived by farmers. The study was conducted with sample of 80 farmer respondents selected from four Agricultural Extension Assistant (AEA) circles of Jorhat district. Total 64 (sixty-four) indigenous pest and disease management practices followed by the farmers in rice, vegetables and fruits including stored grain pests of rice and pulses were explored. All the pest management IATKs used against different pests and diseases at different stages of crops growth were considered. Twenty five (25) Agricultural scientists/teachers of Assam Agricultural University, Jorhat evaluated the recorded IATKs for determining the rationality at institutional level. To measure the effectiveness of IATKs, effectiveness score like highly effective (2.34 -3.00), moderately effective (1.67-2.33) and less effective (1.00-1.66) and rationality scores 0, 1 and 2 as irrational, rational and undecided, respectively of each practice was evaluated to measure the descriptive variables of the study *viz*., "effectiveness and scientific rationality of indigenous pest and disease management practices". Data were analysed using appropriate statistical measures.

RESULTS AND DISCUSSION

Description of explored indigenous pest and disease management practices: Data presented in (Table 1) revealed that out of 35 IATKs practiced by the farmers against different commonly occurring pests of rice, maximum 32 numbers were used mainly against the stem borer, hispa, gundhi-bug, case-worm, rodents and birds. It was observed that 7 number of IATKs like putting of bamboo stick and/or branches, throwing peels of citrus fruits particularly of Rabab tenga (*Citrus grandis*) on standing water, using crushed rhizome of "Keturi Haldhi" in different places of the field, burning rice stubbles and summer ploughing were used for the management of stem borer alone, but in some areas the same were targeted against rice hispa and leaf hopper in addition to stem borer. These findings are in agreement with (Deka *et al.*, 2006) and (Nath *et al.*, 2017) who working with ITKs for the management of important pests of rice reported similar observations. Only three IATK practices were found to be used against major rice diseases caused by fungal and bacterial pathogens. Spraying solution of cow-dung (1 kg raw cow dung/10 l water) along with neem leaf solution (leaf/grinded seeds 50g + soap and/or detergent powder 5 g + turmeric powder 10 g/l water) for the control of foliar diseases recorded to be effective. (Roy *et al*, 2015) also reported information in the similar line. Dusting of ash against brown spot (*Helminthosporium oryzae*) was found as effective as against several chewing and sucking type insects (Roy *et al.*, 2015). It might be due to high content of potash in ash which ultimately gave resistance against the fungal pathogen.

Rice grains mixing of dry curry (*Murraya koenigii*) leaves and neem (*Azadirachta indica*) leaves, top 15 cm layer were found free from the infestation of rice weevil and grain moth. Similarly, green gram seeds treated with neem leaf powder (1%) remain free from all types of stored grain insect- pest infestation. Green gram and black gram seeds smeared with edible oils i.e. mustard oil or coconut oil before storing was found to be effective against bruchids (Roy *et al.*, 2015). Another practice of mixing of sand with pulse grains at the time of storage gave good result against several types of stored insect-pests. This is in agreement with findings of (Gogoi *et al.*, 2017) who reported application of sand layer at the top of stored pulse grains was effective.

In case of vegetables especially in cucurbit growing fields, smoke produced out of burning of distal end of dry chilli attached rope made with strands of rice straw was practiced to keep cucurbits free from fruit fly infestation. Similarly, (Gogoi and Majumder, 2001) also reported about the effectiveness of burning of dried chillies in the vegetable fields for the management of various vegetable pests especially field crickets.

Pouring of fresh milk (80ml/ palm) on the crown region gave good protection against *Rhinocerous* beetle and trunk borer in coconut. Similar findings have also been reported by earlier researchers (Singh and Sureja, 2008; Nath *et al.*, 2017). Production of smoke beneath mango and citrus trees before their flowering by burning dry leaves, twigs etc reduce incidence of different detrimental insect- pests. This is in agreement with (Deka *et al.*, 2006) who also reported about the affectivity of smoke against mango and citrus insects.

Effectiveness of indigenous pest and disease management practices as perceived by farmers: It was found that out of 35 explored indigenous pest and disease management practices in rice, 6, 11and18 IATKs were categorised as highly effective, moderately effective and less effective, respectively as reported by the users. In contrast, no indigenous practice was found to be highly effective in case of stored grains pests (Table 1). In vegetables 3, 4 and 7 IATKs of practices were found as highly effective, moderately effective and less effective, respectively. The highly effective practices against vegetable pests were - application of common salt, drenching of hing (asafoetida) 1g + turmeric powder + 15l water and burning of dried chilli on hole made by pests

Table 1: Indigenous pest and disease management practices of rice, stored grains, vegetables and fruits and their effectiveness as perceived by the farmers.

Sl. No	IATKs/Practices	Against Pest/disease	Stages of application	Nature of effect	Effectiveness score
	1	2	3	4	
	i. Rice				
1	Putting of bamboo stick and/or branches for birds sitting in the main field.	Stem borer and leaf hopper	Tillering	Birds act as predator	1.91 (Moderate)
2	Moving kerosene soaked rope over the crop and draining out available standing water.	Case worm	Tillering	Cases made by case worm are fallen down from crop on standing water and then drained out from field	2.66 (High)
3	Throwing branches of Germany ban (*Chromolaena odorata)*: Biholongoni (*Polygonum hydropiper*) and posotia (*Vitex negundo*) on standing water.	Hispa and case worm	Tillering	All these plant act as repellent as they produce smell intolerable to the pests and pests go away from field	1.32 (Less)
4	Throwing peels of citrus fruits particularly of Rabab tenga (*Citrus grandis*) on standing water.	Stem borer	Tillering	Peels of citrus fruits repel various pests of rice, particularly stem borer	1.64 (Less)
5	Spraying of tobacco leaves solution.	Hispa	Tillering	Since tobacco leaves solution is alkaline in nature, so this solution control the attack of hispa	1.66 (Less)
6	Broadcasting goat's excreta.	Hispa	Tillering	Pests fly away due to disagreeable odour of excreta.	1.45 (Less)
7	Using raw cow dung @ 300 kg/ha approximately on standing water in low land condition.	Crabs	Tillering	Raw cow dung disturb the crabs in movement and produce unbearable odour to them, as a result crabs go off from field.	1.69 (Moderate)
8	Spraying cow-dung (1 kg raw cow dung in 10-12 lit of water solution).	Bacterial leaf blight and stray cattle	Tillering	Cow dung solution controls the bacterial leaf blight to some extent. Further the crop is protected from cattle as because of cattle do not graze the treated crop.	1.74 (Moderate)
9	Using thorny branch of ber (*Zizyphus spp*.) in the field.	Hispa	Tillering	Hispa get injury and disturbance in movement and thereby fly away from the field.	1.56 (Less)
10	Spraying boiled neem leaves and grinned seed solution.	Leaf folder	Tillering	Since the solution is bitter in taste, so treated leaves, stems cannot be attacked by pests easily. Moreover the odour of solution acts as repellent which drive away the pests from field.	1.89 (Moderate)
11	Application of solution of "Keturi Haldhi" (wild turmeric) rhizome (100 g in 1 litre).	Hispa or stem borer	Tillering	It acts as a repellent. It produces bad smell so pests fly.	1.59 (Less)
12	Using crashed rhizome of "Keturi Haldhi" in different places of the field.	Stem borer or hispa	Tillering	It also act as pest repellent. It's disagreeable odour prevent pest attack.	1.66 (Less)
13	Using dead lizards or frogs or crabs inside inverted bamboo pipe in stagnant water so that the lizards or frogs or crabs touch water.	All major insect/pests of rice	Tillering	Dead or rotten lizards or frogs produce disagreeable smell in the standing water so pests fly away from field.	1.36 (Less)

Sl. No	IATKs/Practices	Against Pest/disease	Stages of application	Nature of effect	Effectiveness score
	1	2	3	4	
14	Small bamboo pole or branch is placed in each rice hill in low land situation.	Crab	Tillering	At the time of clasping rice seedlings, the crab get hard and therefore they leave crop field	2.43 (High)
15	Posotia (*Vitex negundo*) leaves are dried, grinded and dusted in the field.	Hispa	Tillering	Due to disagreeable odour by posotia dust, the pest fly away from field	1.63 (Less)
16	Pouring kerosene oil directly on standing water.	Hispa	Tillering	Hispa fly away from field due to intolerable odour of kerosene oil.	1.62 (Less)
17	Refilling available standing water of the field.	Hispa and stem borer	Tillering	Activities of hispa and stem borer are reduced due to non-availability of water in the field	1.62 (Less)
18	Beating empty tin or drum in the field.	Birds	Maturity	Due to sound production the birds are frightened and drive away from field.	2.4 (High)
19	Carcass of a crow is tied to a long pole in the centre of a rice field.	Birds	Maturity	The carcass of crow frighten birds and thus their attack on crop reduces	2.17 (Moderate)
20	Small polythene bags or sheets are tied to a long pole and placed in the centre of the field.	Birds	Maturity	Due to wind, polythene sheets or bags flutter and produce sound which frighten the birds and thereby their attack reduces	1.57 (Less)
21	A piece of black or red cloth is tied to a long pole and placed in the centre of the field.	Birds	Maturity	In the presence of black or red cloth, birds are scared and their attack reduces	2.00 (Moderate)
22	Using bell in the field which is operated from long distance with a long rope.	Birds	Maturity	Due to sound production, birds are frightened and fly away from field	2.14 (Moderate)
23	The field is encircled with reels of cassettes by the help of bamboo.	Birds	Maturity	The reels reflect light and produces sound which frighten away birds from field.	2.67 (High)
24	Using bamboo pipes (2" sizes), inside which a thin wire is placed horizontally with the help of two bamboo pole.	Birds	Maturity	Birds try to sit on bamboo pipe but presence of wire make the bamboo pipe roll which frighten the birds and they fly away.	2.20 (Moderate)
25	Filling up rodent burrows with water.	Rodents	Maturity	After complete filling up of the burrows with water the rodents come out and they are killed by the farmers easily.	1.74 (Moderate)
26	Application of solution of neem leaves and grinded seeds + soap and/or surf (detergent powder) + raw turmeric.	Any fungal and bacterial diseases	Tillering and panicle initiation	The prepared solution produces disagreeable odour and reduces the chances of disease occurrence and thus act as a pre-cautionary measure	1.33 (Less)
27	Dusting of ash	Brown spot	Panicle initiation	Ash checks spreading of infection	1.36 (Less)
28	Use of dead crabs or frogs fixed in bamboo stick in different places of main field.	Gundhi bug	Milking	The dead crabs and/or frogs play the role as attractant. The pest specially Gundhi bug	2.83 (High)

Sl. No	IATKs/Practices	Against Pest/disease	Stages of application	Nature of effect	Effectiveness score
	1	2	3	4	
				crowded over the dead crabs or frogs instead of sucking soft grains and thus attack on crop is controlled	
29	Bonfire or using light at night hours in the field.	Gundhi bug	Milking	It plays role as attractant. Various pests particularly	2.74 (High)
30	Burning rice stubbles.	Stem borer	After harvesting	Gundhi bug jump down on fire and thus controlled Pests and their eggs get burnt and therefore pest population in next crop season becomes less.	1.26 (Less)
31	Fumigating the rodent burrows with smoke of burnt paddy husk.	Rodents	After harvesting	The rodents are suffocated to death due to fumigation and thereby rodent population is reduced in next crop season.	1.83 (Moderate)
32	Digging of the rodent burrows.	Rodents	After harvesting	Rodent attack on next crop season is reduced.	2.02 (Moderate)
33	Cutting tip portion of rice seedlings.	All major insect pests of rice	Before transplantation	Generally insects/pests are present on the tip portion of rice seedlings. Hence removal of tip portion also removes the insect/pests.	1.32 (Less)
34	Cutting the edges of border of the plots.	All hibernated insect pests	Before transplantation	Pests hibernated in the border edges are killed and thus reduces pest population at later stages.	1.19 (Less)
35	Summer ploughing.	Stem borer	Before sowing	Pests and their eggs get injured hence, attack of pest reduces in the next crop season	1.11 (Less)
	ii. Stored grains				
	(a). Rice				
1	Mixing curry (*Murraya koenigii*) leaves and neem (*Azadirachta indica*) leaves with grains.	Weevil and grain moth	At the time of storage	The odour of the leaves keeps away most of the pests of stored grain.	1.39 (Less)
2	Covering grains with a layer of dried paddy husk of 2"-3"	Weevil and grain moth	At the time of storage	Protective paddy husk layer protect the grains from insect damage because of their inability to reach the grain stock.	1.84 (Moderate)
3	Stored grains in bamboo made structure, finally covered with "Bamboo ber" plastered with cow dung and mud. The top of the Ber is then covered or plastered with 1"-2" cow dung and mud mixture.	All stored grain insect/pest of rice	At the time of storage	The structure protects most of the pests to reach grain from outside.	1.55 (Less)
	(b) Black and Green gram				
1	Mixing the grains with ash before storing.	Pulse bruchid	Before storage	Presence of ash hinders the insects/pests.	1.64 (Less)
2	Smearing grains with edible oils (mustard or coconut) before storing.	Pulse bruchid	Before storage	Due to slipperiness of oil the insects/pets cannot attack the grains easily.	1.75 (Moderate)
3	Mixing grains with sand before storing.	All stored grain insect/pests of pulse	Before storage	Due to presence of sand insect/pest get disturbance in movement resulting reduction of infestation.	1.85 (Moderate)

Sl. No	IATKs/Practices	Against Pest/disease	Stages of application	Nature of effect	Effectiveness score
	1	2	3	4	
	iii. Vegetables				
	(a) Potato				
1	Application of salt	Red ant	Seedling	Due to salty characteristics, the pest cannot stay near the treated crop.	2.44 (High)
2	Dusting of ash.	Late blight of potato	Seedling and active vegetative stage	Since ash is alkaline in nature so it reduces disease incidence.	1.28 (Less)
3	Hiding or keeping Banana (var. Bhimkal) just beneath the soil surface of potato field.	Red ant	Seedling	Banana attracts a large number of red ants, so farmer can easily destroy them.	2.09 (Moderate)
4	Incorporation of mustard oil cake into soil.	Red ant	Land preparation	Medicinal properties and other chemicals available with the oil cake reduces the activities of red ant on plant or go away.	1.42 (Less)
	(b) Brinjal				
1	Dusting of ash on plants and around plants.	Fruit and shoot borer	Actively vegetative growing stage and flowering.	As ash is alkaline in nature, the pest cannot stay around the plant and cannot attack leaves or stem containing ash.	1.52 (Less)
2	Using solution of hing (Asafoetida) and raw turmeric.	Wilting and other disease	Actively vegetative growing stage	Medicinal properties of hing and turmeric protect the crop from wilting and other diseases.	2.55 (High)
3	Spraying of tobacco leaves solution.	Aphid, fruit and shoot borer.	Flowering	Alkalinity of tobacco leaves solution reduces the attack of pests.	1.61 (Less)
	(c) Cucurbits (Cucumber, Ridge gourd, Bottle gourd and pumpkin)				
1	A rope is made with rice straw and then dry chilli packets are attached to rope and burnt at one end to produce smoke in the cucurbits growing field.	Fruit fly	Fruiting	Smoke with unbearable odour control the attack of fruit fly.	1.84 (Moderate)
2	Protecting the fruit by covering with rice straw or thatch.	Fruit fly	Fruiting	Fruit fly get difficulty in attacking the covered fruit.	1.94 (Moderate)
3	Throwing the rotten fruits on the road.		Fruiting	Farmers think that further fruit rotting will not take place.	1.84 (Moderate)
	(d) Tomato				
1	Spreading rice straw under tomato plants.	Blight disease	Fruiting	Due to straw the branches of plants and fruit do not touch soil and so fruit rot and blight disease is controlled.	1.30 (Less)
2	Dusting of ash on the plants	Blight	Actively vegetative growing stage	Alkalinity of ash reduces the disease incidence.	1.30 (Less)
	(e) Cauliflower , Cabbage				
1	Ant nests or hives are kept near pest infested pockets of cauliflower and/or cabbage growing field.	Aphid	Seedling	Ants feed upon aphids and so the laters, attack is reduced.	1.50 (Less)

Sl. No	IATKs/Practices	Against Pest/disease	Stages of application	Nature of effect	Effectiveness score
	1	2	3	4	
1	**(f) Chilli** Dried chilli are burnt in front of the holes of cricket pests	Field cricket	Seedling	The crickets come out from the hole due to effect of smoke. Then farmer kill the pest easily.	2.57 (High)
	iv. Fruits				
1	**(a) Citrus** Painting of citrus trunk with lime up to 1-11/2 m.	Trunk borer/ Stem borer	Actively vegetative growing stage	Since lime is alkaline in nature so, the practice reduces the attack of pest.	2.6 (High)
2	Tightly sealing of trunk holes made by pests with bamboo plugs after clearing the holes or otherwise plastering of those with mud.	Trunk borer/ Stem borer	Actively vegetative growing stage	Pest cannot come out from the plant through bore and ultimately die inside the plant.	1.57 (Moderate)
3	Spraying of lime solution in pest infested parts of the plants.	Trunk borer/ Stem borer	Flowering	Due to alkaline characteristics of lime, pest attack gets reduced.	1.57 (Moderate)
4	Dusting of ash on foliage.	Lemon butterfly	Flowering	Since ash are alkaline in nature so, pest fly away from the plant or cannot attack the foliage parts containing ash.	1.35 (Less)
	(b) Coconut				
1	Placing a basket of raw cow dung and a few dry fish at the base of coconut plant in the evening.	*Rhinocerous* beetle	Flowering	The pest come down at night and gather on the raw cow dung where farmer can kill them easily.	2.50 (High)
2	Pouring fresh milk on the shoot portion.	*Rhinocerous* beetle	Flowering	Fresh milk attract the ants which disturb the activities of the pest.	1.67 (Less)
3	Application of mixture of sand on shoot portion.	*Rhinocerous* beetle	Flowering	Sand disturbs the movement and feeding activities of the pest.	2.6 (High)
	(c) Mango				
1	Smokes are produced beneath the tree by burning dried leaves, twigs etc.	Most of the pests of mango	Flowering	Smoke is intolerable to most of the pests of mango and so, flies keep away from the mango tree.	2.35 (High)
2	Banding around tree trunk with a rope, made by rice straw and cow dung.	Mealy bug	Flowering	Banding disturbs the mealy bug to move upward as a result tender portion and flower will be free from attack of the pest.	2.27 (Moderate)

in potato, brinjal and chilli, respectively. In fruit crops, out of 9 explored practices 4, 2 and 3 IATKs were categorised as highly effective, moderately effective and less effective, respectively. Among all the highly effective practices adopted by the farmers two were found effective against coconut pests and one each against citrus and mango pest.

Rationality of the explored indigenous pest and disease management practices by scientists: (Table 2) revealed that out of 35 explored indigenous pest and disease management practices of rice 19 practices were rated as rational by majority of the scientists (more than 50 per cent). In case of stored grains, vegetables and fruit crops 3, 6 and 3 IATKs out of 6, 14 and 9 number of explored practices, respectively were rated to be rational by majority of the scientists (more than 50 per cent).

CONCLUSION

Documentation of indigenous pest and disease management practices will provide scope to the plant

Table 2: Frequency and percentage distribution of scientist respondents according to their perceived level of rationality on explored indigenous pest and disease management practices of rice, stored grain pests, vegetables and fruits.

SI. No.	Explored Indigenous pest and disease management practice	Rational	Undecided	Irrational
	i. Rice			
1	Putting of bamboo stick and/or branches for birds sitting in the main field.	23(92)	1(4)	1(4)
2	Moving a kerosene soaked rope over the crop and draining out available standing water	21(84)	3(12)	1(4)
3	Spraying of tobacco leaves solution.	20(80)	3(12)	2(8)
4	Use of dead crabs or frogs fixed in bamboo stick in different places of main field.	23 (92)	2(8)	0(0)
5	Application of solution of neem leaves and grinded seeds + soap and/or surf (detergent powder) + raw turmeric.	15 (60)	6 (24)	4(16)
6	Spraying cow-dung (1 kg raw cow dung in 10-12 lit of water solution)	19 (76)	4 (16)	2(8)
7	Spraying boiled neem leaves and grinned seed solution.	18 (72)	7 (28)	0(0)
8	Bonfire or using light at night hours in the field.	22(88)	2 (8)	1(4)
9	Summer ploughing	21(84)	3(12)	0(0)
10	Burning of rice stubbles	21(84)	2(8)	2(8)
11	Cutting tip portion of rice seedlings	15 (60)	5(20)	5(20)
12	Small polythene bags or sheets are tied to a long pole and placed in the centre of the field.	18(72)	5(20)	2(8)
13	A piece of black or red cloth is tied to a long pole and placed in the centre of the field.	21(84)	3(12)	1(4)
14	Using bell in the field which is operated from long distance with a long rope.	19(76)	4(16)	2(8)
15	The field is encircled with reels of cassettes by the help of bamboo	18(72)	7(28)	0(0)
16	Fumigating the rodent burrows with smoke of burnt paddy husk.	18(72)	6(24)	1(4)
17	Filling up rodent burrows with water.	19 (76)	6 (24)	0(0)
18	Digging of the rodent burrows.	18 (72)	5(20)	2(8)
19	Beating empty tin or drum in the field	20 (80)	5(20)	0(0)
20	Using bamboo pipes (2" sizes), inside which a thin wire is placed horizontally with the help of two bamboo	12 (48)	13(52)	0(0)
21	Small bamboo pole or branch is placed in each rice hill in low land situation.	7(28)	15(60)	3(12)
22	Using raw cow dung @ 300 kg/ha approximately on standing water in low land condition.	10 (40)	13(52)	2(8)
23	Using dead lizards or frogs or crabs inside inverted bamboo pipe in stagnant water so that the lizards or frogs or crabs touch water.	9(36)	13(52)	3(12)
24	Carcass of a crow is tied to a long pole in the centre of a rice field.	10(40)	13(52)	2(8)
25	Throwing peels of citrus fruits particularly of Rabab tenga (*Citrus grandis*) on standing water.	10(40)	12(48)	3(12)
26	Using crushed rhizome of "Keturi Haldhi" in different places of the field.	12(48)	10(40)	3(12)
27	Cutting the edges of border of the plots	8(32)	9 (36)	8(32)
28	Posotia (*Vitex negundo*) leaves are dried, grinded and dusted in the field.	12(48)	11(44)	3(12)
29	Throwing branches of Germany ban (*Chromolaena odorata)*: Biholongoni (*Polygonum hydropiper*) and posotia (*Vitex negundo*) on standing water.	10 (40)	12(48)	3(12)
30	Using thorny branch of ber (*Zizyphus spp*.) in the field.	8 (32)	10(40)	7(28)
31	Application of solution of "Keturi Haldhi" (wild turmeric) rhizome	12 (48)	12(48)	1(4)
32	Dusting of ash	9 (36)	9(36)	7(28)
33	Pouring kerosene oil directly on standing water	8 (32)	10 (40)	7 (28)
34	Refilling available standing water of the field.	10 (40)	6(24)	9 (36)
35	Broadcasting goat's excreta	8 (32)	7(28)	10(40)
	ii. Stored grain pests			
	(A) Rice			
1	Stored grains in bamboo made "Ber" plastered with cow dung and mud. The top of the Ber is then covered or plastered with 1"-2" cow dung and mud mixture.	15(60)	8(32)	2(8)
2	Covering grains with a layer of dried paddy husk of 2"-3"	10(40)	10(40)	5(20)
3	Mixing curry (*Murraya koenigii*) leaves and neem leaves with grains.	11(44)	10(40)	4(16)
	(B) Black gram and Green gram			
1	Smearing grains with edible oils (mustard or coconut) before storing.	16(64)	6(24)	3(12)
2	Mixing the grains with ash before storing	16(64)	8(32)	1(4)
3	Mixing grains with sand before storing	12(48)	13(52)	0(0)

SI. No.	Explored Indigenous pest and disease management practice	Rational	Undecided	Irrational
	iii. Vegetables			
	(A) Potato			
1	Incorporation of mustard oil cake into soil	16(64)	7(28)	2(8)
2	Application of salt	8(32)	13(52)	4(16)
3	Dusting of ash.	7(28)	13(52)	5(20)
4	Hiding or keeping Banana (var. Bhimkal) just beneath the soil surface of potato field.	10(40)	13(52)	2(8)
	(B) Brinjal			
1	Spraying of tobacco leaves solution.	17(68)	6(24)	2(8)
2	Using solution of hing (Asafoetida) and raw turmeric	13(52)	12(48)	0(0)
3	Dusting of ash on plants and around plants.	11(44)	12(48)	2(8)
	(C) Cucurbits			
1	Throwing the rotten fruits on the road.	18(72)	7(28)	0(0)
2	Protecting the fruit by covering with rice straw or thatch.	13(52)	7(28)	5(20)
3	A rope is made with rice straw and then dry chilli packed are attached to rope and burnt at one end to produce smoke in the cucurbits growing field.	12(48)	13(52)	0(0)
	(D) Tomato			
1	Spreading rice straw under tomato plants.	8(32)	16(64)	1(4)
2	Dusting of ash on the plants	9(36)	15(60)	1(4)
	(E) Cauliflower and cabbage			
1	Ant nests or hives are kept near pest infested pockets of cauliflower and/or cabbage growing field	7 (28)	14(56)	4(16)
	(F) Chilli			
1	Dried chilli are burnt in front of the holes of cricket pests	16 (64)	6 (24)	3 (12)
	iv. Fruits			
	(A) Citrus			
1	Painting of citrus trunk with lime up to 1-11/2 m.	12 (48)	13(52)	0 (0)
2	Spraying of lime solution in pest infested parts of the plants.	11(44)	13(52)	1(4)
3	Dusting of ash on foliage	11(44)	12(48)	2(8)
4	Tightly sealing of trunk holes made by pests with bamboo plugs after clearing the holes or otherwise plastering of those with mud	10 (40)	12 (48)	3 (12)
	(B) Coconut			
1	Application of mixture of sand and BHC dust on shoot portion.	16 (64)	6 (24)	3(12)
2	Placing a basket of raw cow dung and a few dry fish at the base of coconut plant in the evening.	14(56)	10(40)	1(4)
3	Pouring fresh milk on the shoot portion	2 (8)	12(48)	11(44)
	(C) Mango			
1	Smokes are produced beneath the tree by burning dried leaves, twigs etc.	18 (72)	7(28)	0(0)
2	Banding around tree trunk with a rope, made by rice straw and cow dung.	12 (48)	12 (48)	1(4)

protection scientists for further study or trail to determine their effectiveness in controlling pests and diseases. Identified scientifically rational indigenous pest and disease management practices will be helpful to the scientists in technology blending programme and in generation of low cost, non-polluting, location-specific technology by modifying the recommended technology so as to make it more readily acceptable to the farmers both socially and economically. It will also be helpful for the extension personnel in planning and executing the various integrated pest management programme. Extension personnel may tackle the farmers' pest and disease problem by prescribing the effective and rational indigenous pest and disease management practices without going to other chemicals.

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