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Indigenous Agricultural Technical Knowledge for the Management of Common Pests and Diseases of Rice and Stored Grains in Jorhat district, Assam.

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ABSTRACT

A Study on Indigenous Agricultural Technical Knowledge (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 to determine the effectiveness of identified IATKs as perceived by farmers and also to determine the scientific rationality 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 was revealed that in rice among the IATKs studied, 32 numbers 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.

Key words: Effectiveness, IATK, Pest and disease management, Scientific rationality.

INTRODUCTION

Indigenous knowledge 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. Farmers can understand, handle, and maintain them better than introduced improved practices and technologies. Indigenous Knowledge draws on local resources. People are less dependent on outside supplies, which can be costly, scarce and available only irregularly (Langill and Landon,1998). Indigenous Agricultural Technical Knowledge (IATKs) are gaining importance because it has minimum risk factor, heavy reliance on genetic and physical diversity, exploitation of optimum utility of local resources, environmentally healthy, readily available and easily understandable, labour intensive, relevance to local farming system and adaptable to meet multipurpose community needs, based on the cultural values of the community etc. (Gupta *et al*, 1994). Theme study was undertaken with the objective to study Indigenous Knowledge for the management of common pest and diseases.

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 farmers selected from four AEA (Agriculture Extension Assistant) circles of Jorhat district. Total 41 (forty one) indigenous pest and disease management practices (IATKs) followed by the farmers in rice and against stored grain pests of rice, pulses were explored. All

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Table 1. Indigenous pest and disease management practices of rice.

Sr. No	Practice	Against Pest/disease	Stages of application	Nature of effect
	1	2	3	4
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
2	Moving a kerosene soaked rope over the crop and draining out available standing water.	Case worm	Tillering	Cases made by case worm fell down from crop on standing water and then drained out from field
3.	Throwing branches of Germany ban (*Chromolaenaodorata)*, Biholongoni (*Polygonumhydropiper*) and posotia (*Vitexnegundo*) on standing water.	Hispa and case worm	Tillering	All these plants act as repellent as they produce smell intolerable to the pests
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
5.	Spraying of tobacco leaves solution.	Hispa	Tillering	Since tobacco leaves solution is alkaline in nature, so this solution control the attack of hispa
6.	Broadcasting goat's excreta.	Hispa	Tillering	Pests fly away due to disagreeable odour of excreta.
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 and thus as crabs go out from field.
8.	Spraying cow-dung (1 kg raw cow dung in 10-12 ltr of water solution).	Bacterial leaf blight and stray cattle	Tillering	Cow dung solution control the B.L.B to some extent. Further the crop is protected from cattle as because of cattle do not graze the treated crop.
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.
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 act as repellent which drive away the pests from field.

11.	Application of solution of "KeturiHaldhi" (wild turmeric) rhizome.	Hispa or stem borer	Tillering	It acts as a repellent. It produces bad smell so pest fly away from field and thereby crop escaped from pest attack.
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.
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.
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
15.	Posotia (*Vitexne gundo*) leaves are dried, grinded and dusted in the field.	Hispa	Tillering	Due to disagreeable odour by posotia dust, the pest fly away from field
16.	Pouring kerosene oil directly on standing water.	Hispa	Tillering	Hispa fly away from field due to intolerable odour of kerosene oil.
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
18.	Beating empty tin or drum in the field.	Birds	Maturity	Due to sound production the birds are frightened and drive away from field.
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
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
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
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
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.
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.

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.
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
27.	Dusting of ash	Brown spot	Panicle initiation	Ash checks spreading of infection
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 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 Gundhi bug jump down on fire and thus controlled
30.	Burning rice stubbles.	Stem borer	After harvesting	Pests and their eggs get burnt and therefore pest population in next crop season becomes 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.
32.	Digging of the rodent burrows.	Rodents	After harvesting	Rodent attack on next crop season is reduced.
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.
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.
35.	Summer ploughing.	Stem borer	Before sowing	Pests and their eggs get injured hence, attack of pest reduces in the next crop season

Table 2. Indigenous pest and disease management practices of stored rice.

Sr. No	Practice	Against Pest/disease	Stages of application	Nature of effect
	1	2	3	4
1	Mixing curry (*Murrayakoenigii*) leaves and neem (*Azadirachtaindica*) leaves with grains.	Weevil and grain moth		The odour of the leaves keeps away most of the pests of stored grain.
2.	Covering grains with a layer of dried paddy husk of 2"-3"	Weevil and grain moth		Protective paddy husk layer protect the grains from insect damage because of their inability to reach the grain stock.
3.	Stored grains in bamboo madestructure, 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		The structure protects most of the pests to reach grain from outside.

the IATKs used against attacking different pests and diseases at different stages of the respective crops/ plants growth were considered. The field level data were collected by using pre-tested structured schedule. 25 Agricultural scientists/teachers of AAU, 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) for farmers and rationality score 0, 1 and 2 as irrational, rational and undecided, respectively of each practice for Scientists were found out. The descriptive variables of the study- effectiveness and scientific rationality of indigenous pest and disease management practices were evaluated. Data were subjected to statistical analyses (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

Description of explored indigenous pest and disease management practices

The data (Table 1) revealed that out of 35 AITKs 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 numbers 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 crashed 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 were in agreement with Deka *et al*, (2017) and Nath *et al*, (2017) who working with ITKs for the management of important pests of rice reported similar observations. Only three AITK 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 powder10 g/l water) for the control

Table 3. Effectiveness of indigenous pest and disease management practices of rice as perceived by the farmers.

Sr. No.	Explored Indigenous pest and disease management practice	Effectiveness score
1.	Moving kerosene soaked rope over the crop and draining out available standing water.	2.66 (High)
2.	Use of dead crabs or frogs fixed in bamboo stick in different places of main field.	2.83 (High)
3.	Bonfire or using light at night hours in the field.	2.74 (High)
4.	Small bamboo pole or branch is placed in each rice hill in low land situation.	2.43 (High)
5.	Beating empty tin or drum in the field.	2.40 (High)
6.	The field is encircled with reels of cassettes by the help of bamboo.	2.67 (High)
7.	Putting of bamboo stick and/or branches for birds sitting in the main field.	1.91 (Moderate)
8.	Using raw cow dung @ 300 kg/ha approximately on standing water in low land condition.	1.69 (Moderate)
9.	Spraying cow-dung (1 kg raw cow dung in 10-12 lit of water solution)	1.74 (Moderate)
10.	Spraying boiled neem leaves and grinned seed solution.	1.89 (Moderate)
11.	Carcass of a crow is tied to a long pole in the centre of a rice field.	2.17 (Moderate)
12.	A piece of black or red cloth is tied to a long pole and placed in the centre of the field.	2.00 (Moderate)
13.	Using bell in the field which is operated from long distance with a long rope.	2.14 (Moderate)
14.	Using bamboo pipes (2” sizes), inside which a thin wire is placed horizontally with the help of two bamboo.	2.20 (Moderate)
15.	Fumigating the rodent burrows with smoke of burnt paddy husk.	1.83 (Moderate)
16.	Filling up rodent burrows with water	1.74 (Moderate)
17.	Digging of the rodent burrows.	2.02 (Moderate)
18.	Throwing branches of Germany ban (*Chromolaenaodorata)*: Biholongoni (*Polygonumhydropiper*) and posotia (*Vitexnegundo*) on standing water.	1.32 (Less)
19.	Throwing peels of citrus fruits particularly of Rabab tenga (*Citrus grandis*) on standing water.	1.64 (Less)
20.	Spraying of tobacco leaves solution.	1.66 (Less)
21.	Application of solution of neem leaves and grinded seeds + soap and/or surf (detergent powder) + raw turmeric.	1.33 (Less)
22.	Using thorny branch of ber (*Zizyphus spp*.) in the field.	1.56 (Less)
23.	Application of solution of “KeturiHaldhi” (wild turmeric) rhizome.	1.59 (Less)
24.	Using crashed rhizome of “KeturiHaldhi” in different places of the field.	1.60 (Less)
25.	Using dead lizards or frogs or crabs inside inverted bamboo pipe in stagnant water so that the lizards or frogs or crabs touch water.	1.36 (Less)
26.	Summer ploughing.	1.11 (Less)
27.	Burning of rice stubbles.	1.26 (Less)
28.	Posotia (*Vitexnegundo*) leaves are dried, grinded and dusted in the field.	1.63 (Less)
29.	Dusting of ash	1.36 (Less)
30.	Cutting tip portion of rice seedlings.	1.32 (Less)
31.	Pouring kerosene oil directly on standing water.	1.56 (Less)
32.	Refilling available standing water of the field.	1.62 (Less)
33.	Cutting the edges of border of the plots.	1.19 (Less)
34.	Broadcasting goat’s excreta.	1.45 (Less)
35.	Small polythene bags or sheets are tied to a long pole and placed in the centre of the field.	1.57 (Less)

Table 4. Effectiveness of indigenous pest and disease management practices of stored grains as perceived by the farmers.

Sr. No.	Explored Indigenous pest and disease management practice	Effectiveness score
1.	Covering grains with a layer of dried paddy husk of 2"-3".	1.84 (Moderate)
2.	Mixing curry (*Murrayakoenigii*) leaves and neem leaves with grains.	1.39 (Less)
3.	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.	1.55 (Less)

Table 5. Perrceived level of rationality on explored indigenous pest and disease management practices of rice. N= 25

Sr. No.	Explored Indigenous pest and disease management practice	Rational	Undecided	Irrational
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 crashed rhizome of "KeturiHaldhi" 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 (*Vitexnegundo*) leaves are dried, grinded and dusted in the field.	12(48)	11(44)	3(12)
29.	Throwing branches of Germany ban (*Chromolaenaodorata)*: Biholongoni (*Polygonumhydropiper*) and posotia (*Vitexnegundo*) 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 "KeturiHaldhi" (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)

(Figures in the parentheses indicate percentage).

of foliar diseases recorded to be effective. Roy *et al* (2015) also reported information in the similar line.

In case of stored grains (Table 2) Green gram seeds treated with neem leaf powder (1%) remained 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 was in agreement with findings of Gogoi *et al* (2017) who reported application of sand layer at the top of stored pulse grains was effective.

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 nos. of AITKs 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 3).

Rationality of the explored indigenous pest and disease management practices by Scientists

The data (Table 4) 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 (> 50%). In case of stored grains 3 no's of indigenous practices out of 6 nos. of explored practices were rated to be rational by majority of the scientists (> 50%).

CONCLUSION

Documentation of indigenous pest and disease management practices will provide scope to the plant protection scientists for further study 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.

Table 6. Perceived level of rationality on explored indigenous pest and disease management practices of stored grains. N=25

Sr. No.	Explored Indigenous pest and disease management practice.	Rational	Undecided	Irrational
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 (*Murrayakoenigii*) leaves and neem leaves with grains.	11(44)	10(40)	4(16)

(Figures in the parentheses indicate percentage)

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