ADOPTION OF BINA DEVELOPED RICE, PULSE, OILSEED AND HORTICULTURAL CROP VARIETIES IN BANGLADESH

M.H. Rahman*, M.M.A. Sarkar, S. Islam and R. Sultana

Abstract

The study was conducted in 64 districts of Bangladesh to assess the area coverage of BINA developed rice, pulse, oilseed and horticultural crop varieties during 2021-22. Field survey data were collected from 64 districts through concern DD, DAE office. Both tabular and descriptive statistical analysis was used. It was observed that the overall area coverage of BINA developed rice varieties were 8.20%. Among the three seasons; Aus, Aman and Boro the highest area coverage was found in Aman season that was 13.04% followed by Aus 4.37% and Boro 2.76%, respectively. Among the 14 agricultural regions the highest area coverage of rice was found 17.10% in Rajshahi region (Reg-7) and the lowest found 0.70% in Dhaka region (Reg-11). The overall area coverage of BINA developed pulse varieties were 3.05% and among the 14 regions the highest area coverage for pulses was found Barishal region 69.64% (Reg-6). The overall area coverage of BINA developed oilseed varieties were 3.51% and among the 14 regions the highest area coverage for oilseed was found in Jashore region 16.12% (Reg-13) and the lowest was found in Rangamati region 1.05% (Reg-4). Among the BINA developed horticultural varieties the highest area coverage was found 0.4348% for Binalebu-1 followed by Binarosun-1 (0.3807%) and Binatomato-7 (0.1695%). It was also observed that, among the 14 regions the highest area coverage for Binalebu-1 and Binatomato-7 were found in Mymensingh agricultural region (region-2) about 210.00 ha (61.27%) and 48.00 ha (80.00%), respectively. But the highest area coverage for Binarosun-1 was found 198.00 ha (59.46%) in Rajshahi agricultural region (region-7). The study identified some constraints such as-non availability of seed, lack of training, demonstrations, field day, collaboration etc. For more dissemination, it is necessary to ensure the seed demand, training, demonstration as well as collaboration among research institutes, DAE, BADC and NGOs should be emphasized.

Keywords: Area coverage, BINA variety, Rice, Pulse, Oilseed, Horticultural crop

Introduction

The economy of Bangladesh is based on agriculture, where land is the most basic natural resource. Land supports the rural economy, being the major focus for the poverty alleviation process. Agriculture plays a leading role in the development and stability of the economy of Bangladesh. Agriculture is the single largest producing sector of the economy and contributes about 13.02% to the total Gross Domestic Product (GDP) of the country (BBS, 2021). This sector also accommodates around 40.6% (in 2016-17) of labour force.

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Due to natural calamities like flood cyclone, drought, loss of production in both food and cash crops are almost a regular phenomenon. The current world population is over 6 billion and will reach 8 billion in 2030. Meanwhile, the annual loss of land to other use is 10 to 35 million ha, with half of this lost land coming from cropland. The problem, however, is that the per capita land area is one of the lowest in the world, estimated at 0.12 ha. In addition, the mostly unplanned economic growth in the past has led to environmental degradation and adversely affected the resilience of society. The arable land in Bangladesh is 15.92 million hectares about 60 percent of the total land area which is contributing to feed 160 million people in Bangladesh. The country has a favorable natural environment for crop production. Of the arable land, 13.39 percent is under single cropping, 25.57 percent double cropping, 11.5 percent triple cropping, 0.10 quadruple cropping and 2.86 percent currently fallow land (BBS, 2019). Here, Cropping Intensity increases up to 197% (BBS 2019). Among various issues such as agriculture, water, energy, climate change, disaster risk reduction and disaster management, food security considered as the key priority for sustainable development in Bangladesh. As population is increasing, cultivable land is decreasing day by day. Facing such severe situation of population growth pressure plus cropland reduction, it is obvious that the only way to solve food shortage problem is to greatly enhance the yield level of food crops per unit land area through advance of science and technology. Keeping this in mind to feed the growing population the scientists of Bangladesh Institute of Nuclear Agriculture (BINA) has developed 124 high yielding varieties (HYV), those are cultivating in all over Bangladesh.

Getting a new idea adopted, even when it has obvious advantages, is difficult (Rogers, 2003). It is a common experience that the adoption of an apparently useful agricultural technology is slower than predicted, or desired, by extension agents (Röling, 1988). Masangano and Miles (2004) pointed out "when an agricultural program introduces a new agricultural technology, the program must be able to evaluate whether the technology has been adopted. Of equal importance is the need to identify the factors that influence adoption". The success of any variety depends on its dissemination among the potential users, which ultimately is measured by the level of adoption of the variety. Although some research on the adoption of BINA varieties has been conducted in Bangladesh, no study has dealt with post adoption actors, i.e. continuing adopters or de-adopters (those who discontinue after having previously adopted).

After the release of varieties, due to the lack of information flow and experience with the new varieties, adoption was limited and slow. In order to prepare programs and courses of action for wider adoption of varieties, it is important to know the current status of BINA varieties in Bangladesh in terms of area they brought under cultivation. The following specific objectives were set to guide the study: i) to examine the area coverage of BINA developed rice, pulse, oilseed and horticultural crop varieties; ii) to identify major constraints of cultivating BINA developed rice, pulse, oilseed and horticultural crop varieties; and iii) to suggest some policy guidelines.

Materials and Methods

The land use pattern of Bangladesh is influenced by agro ecology, soil physiographic and climatic factors (BBS, 2019). Considering the variations of all these factors the total land area of Bangladesh DAE classified fourteen agricultural regions of Bangladesh (Fig. 1). The 14 agricultural regions were assigned such as Reg-1: Cumilla region (Cumilla, B. Baria, Chandpur), Reg-2: Mymensingh region (Mymensingh, Sherpur, Kishoregonj, Netrokona, Jamalpur), Reg-3: Sylhet region (Sylhet, Moulvibazar, Habiganj, Sunamganj), Reg-4: Rangamati region (Khagrachari, Bandarban, Rangamati) Reg-5: Khulna region (Khulna, Bagerhat, Meherpur, Kushtia, Chuadanga, Satkhira), Reg-6: Barishal (Potuakhali, Jhalokati, Bhola, Borguna, Pirojpur, Barishal), Reg-7: Rajshahi region (Rajshahi, Pabna, Naogaon,

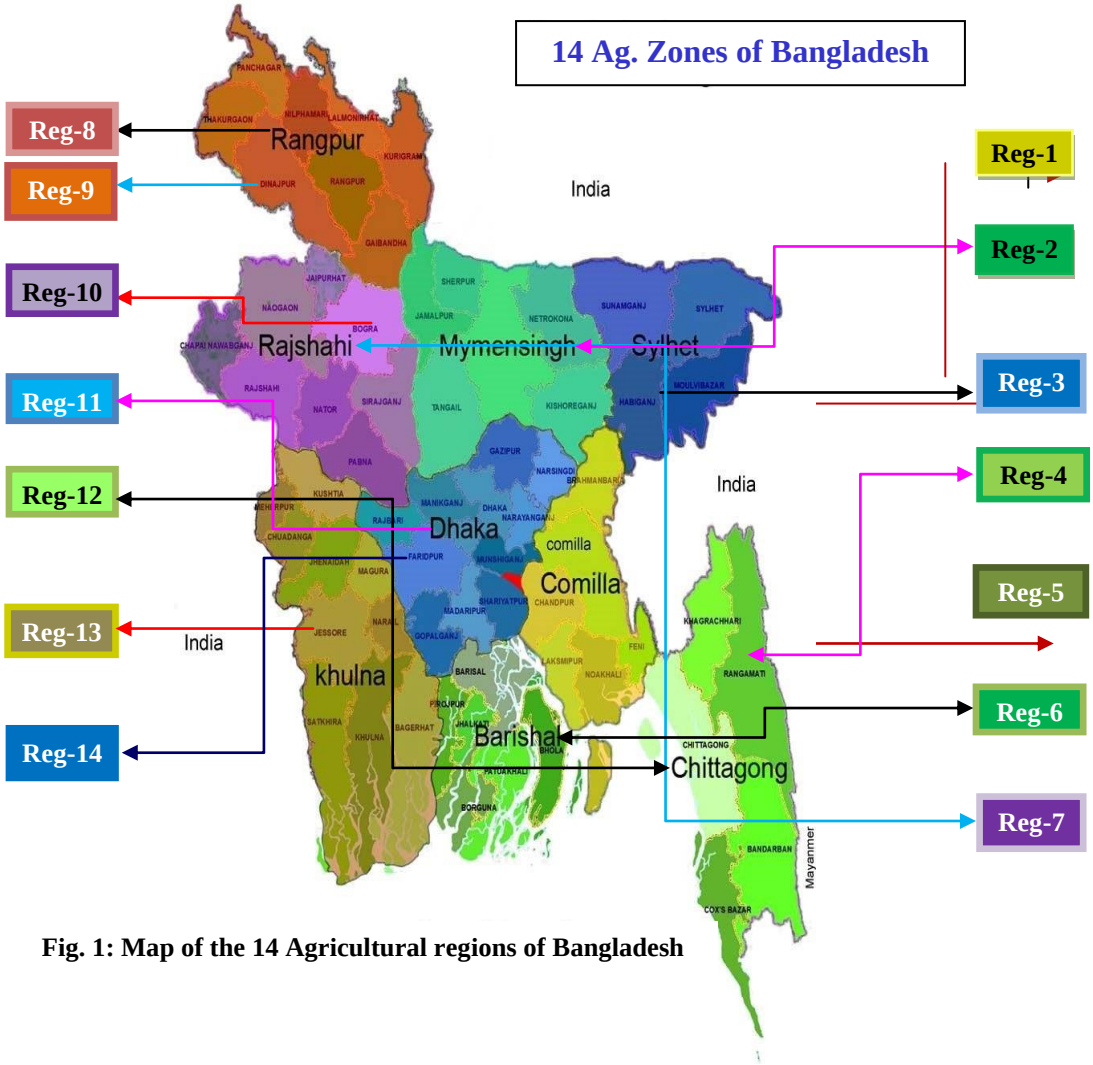

Fig. 1: Map of the 14 Agricultural regions of Bangladesh

Sirajganj, Natore, Chapainawabganj), Reg-8: Rangpur Region (Gaibandha, Lalmonirhat, Rangpur, Kurigram), Reg-9: Dinajpur region (Dinajpur, Panchagarh, Thakurgaon, Nilphamary), Reg10: Bogura region (Bogura, Joypurhat), Reg-11: Dhaka region (Narsingdi, Narayanganj, Gazipur, Tangail, Manikganj, Munshiganj), Reg-12: Chattagram region (Noakhali, Cox's Bazar, Feni, Lakshmipur, Chattagram), Reg-13: Jashore region (Jashore, Narail, Magura, Jhenaidah), Reg-14: Faridpur region (Rajbari, Madaripur, Faridpur, Sariatpur, Gopalganj). The study was conducted in 64 districts under fourteen agricultural regions of Bangladesh in collaboration with concerned sub-stations and regional station of BINA. In total sixty four data were collected through pre-designed interview schedule using structural questionnaire from concern Deputy Director, Department of Agricultural Extension (DD, DAE) of 64 districts. A stratified random sampling technique was employed in selecting the data. Data were collected using a pre-tested questionnaire. Through prior consultation, a six-page questionnaire was designed formatted with open and closed question items to obtain both quantitative and qualitative data. In the questionnaire per hectare area of BINA developed rice (aus, aman and boro), pulses, oilseed and horticultural crop varieties were included to fulfill the objectives. Besides, secondary data from Bangladesh Bureau of Statistics (BBS) was also used. Tabular and descriptive statistics using mean, average and percentage were used to analyze the collected data. The period of data collection was 1 April to June 30, 2022.

Results and Discussion

It was observed that the overall area coverage of BINA developed rice varieties were 8.20% considering the whole Bangladesh (Table 1). Among the three seasons (Aus, Aman and Boro) the highest area coverage was found in Aman season that was 13.04% followed by Aus 4.37% and Boro 2.76%, respectively (Fig. 2). In Aman season, the highest coverage was 8.22% for Binadhan-7 and the lowest was 0.0006% for Binadhan-23 as a newly developed variety. In Boro season, the highest coverage was 1.56% for Binadhan-10 and the lowest was 0.02% for Binadhan-5. In Aus season, the highest coverage was 3.33% for Binadhan-19 and the lowest was 0.24% for Binadhan-21 (Fig. 3).

The results presented in Table 2 depicted that among three seasons, area coverage was the highest for Aman that was 81.47% followed by Boro 12.88% and it was the lowest for Aus i.e. 5.65%. Among the 14 agricultural regions the highest area coverage was found 17.10% in Rajshahi region (Reg-7) and the lowest found 0.69% in Dhaka region (Reg-11) (Fig 4.). In Rajshahi region, the highest area was found for Aman season 113523 ha and the lowest was found for Boro season 1749 ha. In Dhaka region, total Aman area was 4152 ha and Aus area was 180 ha.

Table 1. Variety wise area coverage of BINA developed rice varieties in 2021-22

(In ha)

Rice	Varieties	Cultivated Area	Varietal Adoption (%)	Area Coverage (%)
Boro	Binadhan-5	552.00	0.08	0.0171
	Binadhan-6	4152.00	0.60	0.1289
	Binadhan-8	13549.05	1.96	0.4206
	Binadhan-10	50220.06	7.27	1.5588
	Binadhan-14	16303.50	2.36	0.5061
	Binadhan-18	3927.00	0.57	0.1219
	Binadhan-22	288.00	0.04	0.0089
	Sub-total	**88991.61**	**12.88**	**2.7623**
Aus	Iratom-24	3321.00	0.48	0.3724
	Binadhan-14	3831.00	0.55	0.4296
	Binadhan-19	29741.01	4.31	3.3348
	Binadhan-21	2102.40	0.30	0.2357
	Sub-total	**38995.41**	**5.65**	**4.3725**
Aman	Binashail	60.00	0.01	0.0014
	Binadhan-7	354855.99	51.37	8.2246
	Binadhan-11	42877.35	6.21	0.9938
	Binadhan-12	3348.00	0.48	0.0776
	Binadhan-13	327.00	0.05	0.0076
	Binadhan-15	90.00	0.01	0.0021
	Binadhan-16	6868.89	0.99	0.1592
	Binadhan-17	139431.27	20.19	3.2317
	Binadhan-20	10600.89	1.53	0.2457
	Binadhan-22	4276.50	0.62	0.0991
	Binadhan-23	27.00	0.00	0.0006
	Sub-total	**562762.89**	**81.47**	**13.0434**
	Total	**690749.91**	**100.00**	**8.1959**

Source: DAE data, 2021-22 and BBS 2021

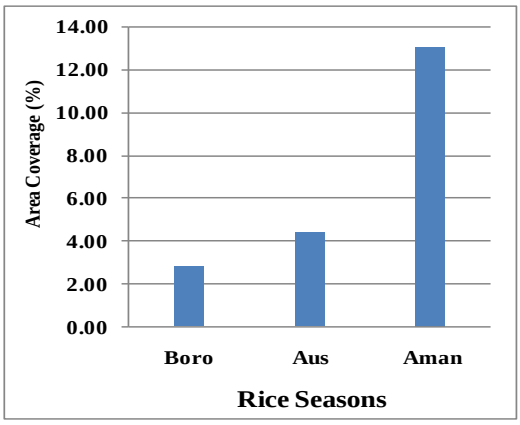

Fig. 2. Cultivated areas of BINA developed rice (%)

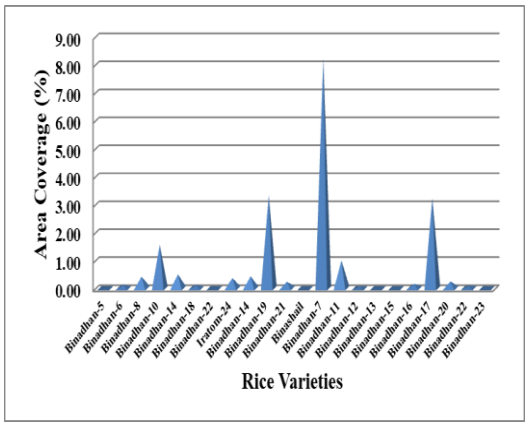

Fig. 3. Area coverage of BINA developed rice (%)

Table 2. Region-wise area coverage of BINA developed rice varieties during 2021-22

Region	Boro		Aus		Aman		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Reg-1	2103.00	2.36	2001.00	5.13	20373.00	3.62	24477.00	3.54
Reg-2	3095.55	3.48	3511.89	9.01	57363.48	10.19	63970.92	9.26
Reg-3	8856.00	9.95	8931.00	22.90	33969.00	6.04	51756.00	7.49
Reg-4	127.56	0.14	199.02	0.51	5120.16	0.91	5446.74	0.79
Reg-5	11547.00	12.98	3030.00	7.77	53497.50	9.51	68074.50	9.86
Reg-6	38817.00	43.62	5121.00	13.13	16893.00	3.00	60831.00	8.81
Reg-7	1749.00	1.97	2877.00	7.38	113523.00	20.17	118149.00	17.10
Reg-8	3322.50	3.73	5904.00	15.14	50544.00	8.98	59770.50	8.65
Reg-9	480.00	0.54	54.00	0.14	8427.75	1.50	8961.75	1.30
Reg-10	267.00	0.30	2233.50	5.73	28410.00	5.05	30910.50	4.47
Reg-11	468.00	0.53	180.00	0.46	4152.00	0.74	4800.00	0.69
Reg-12	6756.00	7.59	711.00	1.82	6198.00	1.10	13665.00	1.98
Reg-13	8502.00	9.55	1290.00	3.31	92076.00	16.36	101868.00	14.75
Reg-14	2901.00	3.26	2952.00	7.57	72216.00	12.83	78069.00	11.30
All	88991.61	12.88	38995.41	5.65	562762.89	81.47	690749.91	100.00

Source: DAE data, 2021-22

Note: Reg-1: Cumilla region, Reg-2: Mymensingh region, Reg-3: Sylhet region, Reg-4: Rangamati region, Reg-5: Khulna region, Reg-6: Barishal region, Reg-7: Rajshahi region, Reg-8: Rangpur region, Reg-9: Dinajpur region, Reg10: Bogura region, Reg-11: Dhaka region, Reg-12: Chattogram region, Reg-13: Jashore region and Reg-14: Faridpur region.

The results presented in Table 3 showed that the overall area coverage of BINA developed pulse varieties were 3.05%. The highest area as well as coverage was found 1.02% for Binamoog-5, respectively and lowest was seen 0.0003% in case of Binasola-6 (Fig 5).

Table 3. Variety-wise area coverage of BINA developed pulse varieties in 2021-22 (In ha)

Crop	Varieties	Cultivated Area	Varietal Adoption (%)	Area Coverage (%)
Pulse	Binamasur-1	50.00	0.09	0.0027
	Binamasur-4	155.00	0.27	0.0083
	Binamasur-5	5062.50	8.92	0.2720
	Binamasur-6	645.00	1.14	0.0347
	Binamasur-7	135.00	0.24	0.0073
	Binamasur-8	2822.50	4.97	0.1516
	Binamasur-9	100.00	0.18	0.0054
	Binamasur-10	12.50	0.02	0.0007
	Binamoog-5	19030.00	33.52	1.0224
	Binamoog-6	15744.58	27.73	0.8459
	Binamoog-7	2952.50	5.20	0.1586
	Binamoog-8	7425.83	13.08	0.3990
	Binamoog-9	207.50	0.37	0.0111
	Binasola-3	167.50	0.29	0.0090
	Binasola-4	10.00	0.02	0.0005
	Binasola-6	5.00	0.01	0.0003
	Binakhesari-1	1855.00	3.27	0.0997
	Binamas-1	400.00	0.70	0.0215
	Total	56780.40	100	3.0506

Source: DAE data, 2021-22 and BBS 2021

It was observed from Table 4, among the 14 regions the highest area coverage for pulses was found Barishal region 69.63% (Reg-6) and the lowest was found Chattogram region 0.00% (Reg-12), respectively.

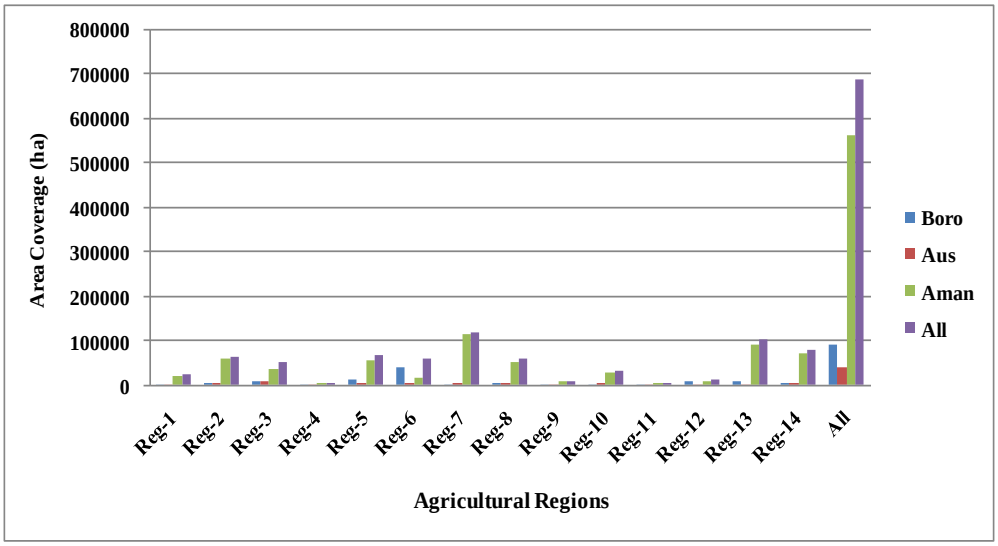

Fig. 4: Regional coverage of BINA developed rice varieties during 2021-2022 in ha

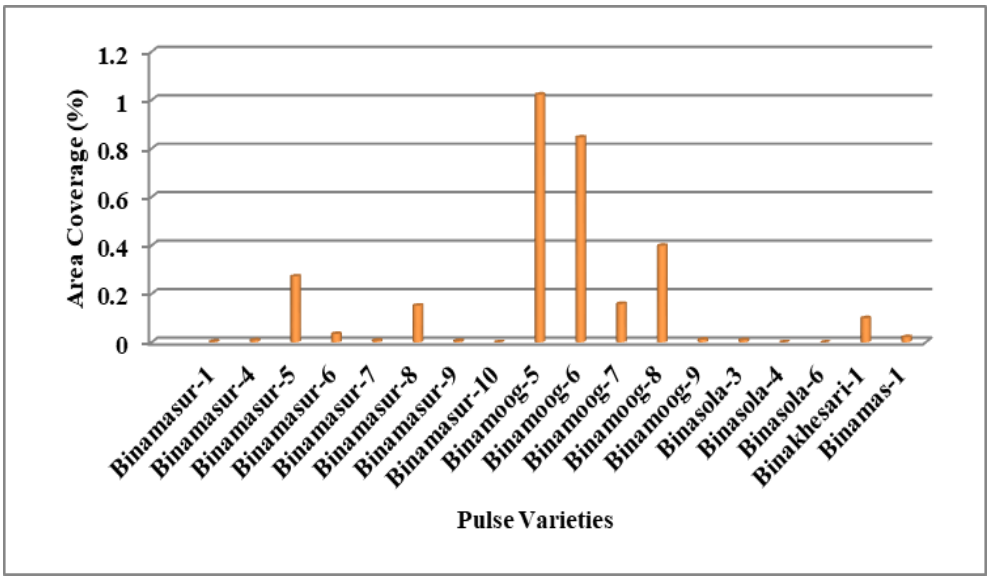

Fig. 5: Variety wise area coverage of BINA developed Pulse varieties in 2021-2022 in %

Table 4. Region-wise adoption of BINA developed Pulse varieties during 2021-22

Region	Binamasur		Binamoog		Binasola		Binakhesari		Binamas		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Reg-1	0.00	0.00	422.50	0.93	0.00	0.00	0.00	0.00	0.00	0.00	422.50	0.73
Reg-2	55.00	0.61	30.00	0.07	0.00	0.00	400.00	15.73	0.00	0.00	485.00	0.84
Reg-3	0.00	0.00	112.50	0.25	2.50	1.37	15.00	0.59	0.00	0.00	130.00	0.23
Reg-4	25.00	0.28	5.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	30.00	0.05
Reg-5	425.00	4.73	478.75	1.05	0.00	0.00	0.00	0.00	0.00	0.00	903.75	1.57
Reg-6	52.50	0.58	38212.50	83.86	167.50	91.78	1725.00	67.85	0.00	0.00	40157.50	69.63
Reg-7	1300.00	14.47	4020.00	8.82	0.00	0.00	75.00	2.95	250.00	62.50	5645.00	9.79
Reg-8	0.00	0.00	85.00	0.19	0.00	0.00	302.50	11.90	0.00	0.00	387.50	0.67
Reg-9	0.00	0.00	6.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	6.65	0.01
Reg-10	12.50	0.14	42.50	0.09	5.00	2.74	0.00	0.00	0.00	0.00	60.00	0.10
Reg-11	0.00	0.00	2.50	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00
Reg-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reg-13	4662.50	51.91	1560.00	3.42	0.00	0.00	25.00	0.98	0.00	0.00	6247.50	10.83
Reg-14	2450.00	27.28	587.50	1.29	7.50	4.11	0.00	0.00	150.00	37.50	3195.00	5.54
All	8982.50	15.57	45565.40	79.01	182.50	0.32	2542.50	4.41	400.00	0.69	57672.90	100.00

Source: DAE data, 2021-22

Note: **Reg-1:** Cumilla region, **Reg-2:** Mymensingh region, **Reg-3:** Sylhet region, **Reg-4:** Rangamati region, **Reg-5:** Khulna region, **Reg-6:** Barishal region, **Reg-7:** Rajshahi region, **Reg-8:** Rangpur region, **Reg-9:** Dinajpur region, **Reg10:** Bogura region, **Reg-11:** Dhaka region, **Reg-12:** Chattogram region, **Reg-13**: Jashore region, and **Reg-14:** Faridpur region.

From Table 5, it was found that, the overall area coverage of BINA developed oilseed varieties were 3.51%. The highest area coverage was found 1.09% for Binasarisha-4 and the lowest 0.0003% was seen in case of Binasarisha-6 (Fig 6).

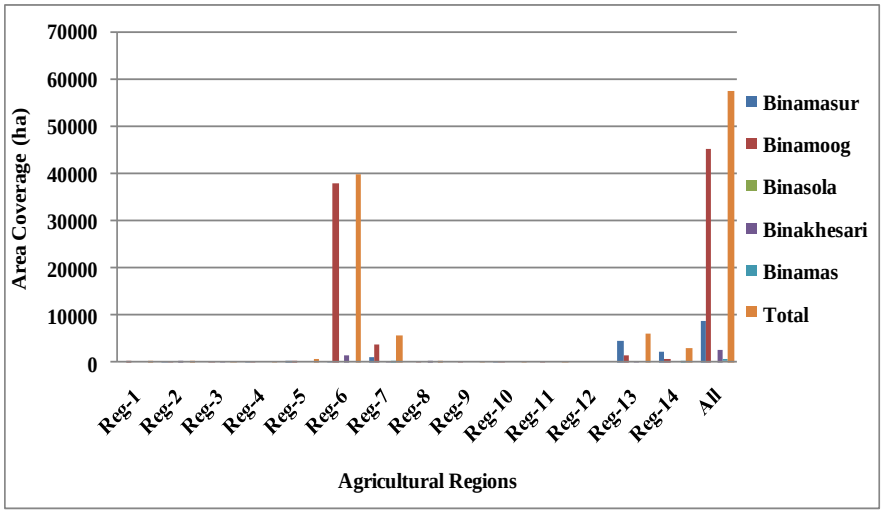

Fig. 6: Region-wise adoption of BINA developed Pulse varieties during 2021-22

Table 5. Variety-wise area coverage of BINA developed oilseed varieties during 2021-22

(In ha)

Crop	Varieties	Cultivated Area	Varietal Adoption (%)	Area Coverage (%)
Oil Seed	Binasarisha-4	24640.00	31.20	1.0959
	Binasarisha-5	22.50	0.03	0.0010
	Binasarisha-6	7.50	0.01	0.0003
	Binasarisha-7	732.50	0.93	0.0326
	Binasarisha-8	8745.00	11.07	0.3890
	Binasarisha-9	20105.83	25.46	0.8943
	Binasarisha-10	1002.58	1.27	0.0446
	Binasarisha-11	150.00	0.19	0.0067
	Binasoybean-3	142.50	0.18	0.0063
	Binasoybean-5	95.00	0.12	0.0042
	Binasoybean-6	255.00	0.32	0.0113
	Binachinabadam-2	255.00	0.32	0.0113
	Binachinabadam-3	125.00	0.16	0.0056
	Binachinabadam-4	7994.15	10.12	0.3556
	Binachinabadam-5	20.00	0.03	0.0009
	Binachinabadam-6	457.50	0.58	0.0203
	Binachinabadam-7	160.40	0.20	0.0071
	Binachinabadam-8	1747.50	2.21	0.0777
	Binachinabadam-9	315.00	0.40	0.0140
	Binachinabadam-10	17.50	0.02	0.0008
	Binatil-1	3512.50	4.45	0.1562
	Binatil-2	2132.50	2.70	0.0948
	Binatil-3	2870.00	3.63	0.1276
	Binatil-4	3465.65	4.39	0.1541
	Total	**78971.10**	**100.00**	**3.5124**

Source: DAE data, 2021-22 and BBS 2021

From Table 6, it was found that among the 14 regions the highest area coverage for oilseed was found in Jashore region 16.12% (Reg-13) and the lowest was found in Rangamati region 1.05% (Reg-4) (Fig. 7 and Fig. 8).

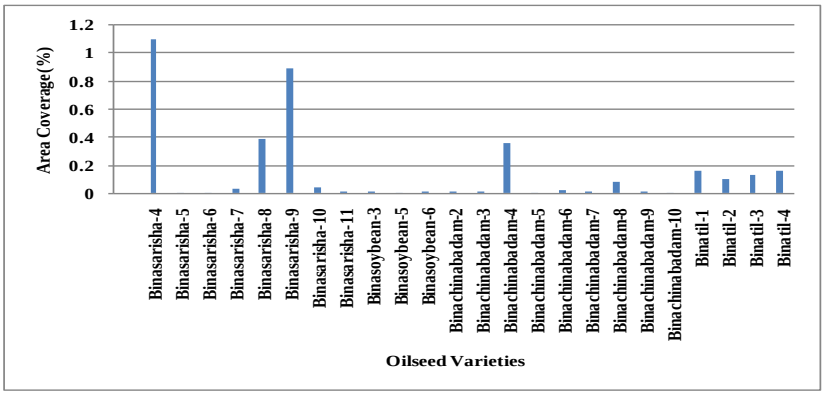

Fig. 7. Variety-wise area coverage of BINA developed oilseed varieties during 2021-22

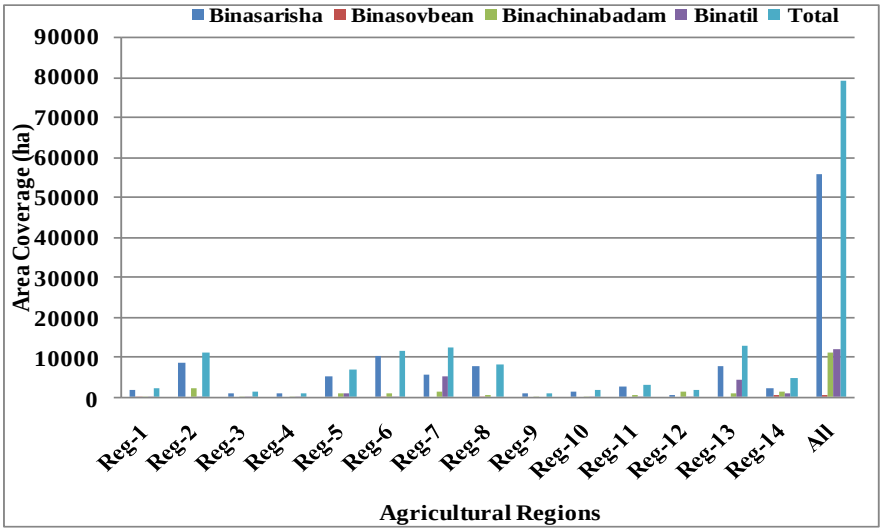

Fig. 8. Cultivated areas of BINA developed oilseed varieties in 14 Ag. regions of Bangladesh

Table-6. Region-wise adoption of BINA developed Oilseed varieties during 2021-22

Region	Binasarisha		Binasoybean		Binachinabadam		Binatil		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Reg-1	1835.00	3.31	147.50	29.95	152.50	1.37	130.00	1.09	2265.00	2.87
Reg-2	8692.18	15.69	0.00	0.00	2365.00	21.32	20.00	0.17	11077.18	14.03
Reg-3	992.50	1.79	0.00	0.00	172.50	1.56	12.50	0.10	1177.50	1.49
Reg-4	745.30	1.35	0.00	0.00	80.80	0.73	0.65	0.01	826.75	1.05
Reg-5	4956.75	8.95	0.00	0.00	886.25	7.99	945.00	7.89	6788.00	8.60
Reg-6	10182.50	18.38	100.00	20.30	1072.50	9.67	140.00	1.17	11495.00	14.56
Reg-7	5335.00	9.63	0.00	0.00	1470.00	13.25	5295.00	44.20	12100.00	15.32
Reg-8	7572.50	13.67	7.50	1.52	675.00	6.09	0.00	0.00	8255.00	10.45
Reg-9	774.18	1.40	0.00	0.00	175.00	1.58	0.00	0.00	949.18	1.20
Reg-10	1420.00	2.56	0.00	0.00	50.00	0.45	200.00	1.67	1670.00	2.11
Reg-11	2702.50	4.88	0.00	0.00	325.00	2.93	112.50	0.94	3140.00	3.98
Reg-12	490.00	0.88	0.00	0.00	1410.00	12.71	7.50	0.06	1907.50	2.42
Reg-13	7487.50	13.51	0.00	0.00	920.00	8.29	4325.00	36.10	12732.50	16.12
Reg-14	2220.00	4.01	237.50	48.22	1337.50	12.06	792.50	6.61	4587.50	5.81
Total	55405.90	70.16	492.50	0.62	11092.05	14.05	11980.65	15.17	78971.10	100.00

Source: DAE data, 2021-22

Note: **Reg-1:** Cumilla region, **Reg-2:** Mymensingh region, **Reg-3:** Sylhet region, **Reg-4:** Rangamati region, **Reg-5:** Khulna region, **Reg-6:** Barishal region, **Reg-7:** Rajshahi region, **Reg-8:** Rangpur region, **Reg-9:** Dinajpur region, **Reg10:** Bogura region, **Reg-11:** Dhaka region, **Reg-12:** Chattogram region, **Reg-13**: Jashore region, and **Reg-14:** Faridpur region.

From Table 7, it was found that, the overall area coverage of BINA developed horticultural crop varieties were 0.3648%. The highest area coverage was found 0.4348% for Binalebu-1 followed by Binarosun-1 (0.3807%) and Binatomato-7 (0.1695%) (Fig 9).

Table 7. Variety-wise area coverage of BINA developed horticultural crop varieties during 2021-22

(In ha)

Crop	Varieties	Cultivated Area	Varietal Adoption (%)	Area Coverage (%)
Horticultual	Binalebu-1	342.75	46.59	0.4348
	Binarosun-1	333.00	45.26	0.3807
	Binatomato-7	60.00	8.15	0.1695
	Total	735.75	100	0.3648

Source: DAE data, 2021-22 and BBS 2021

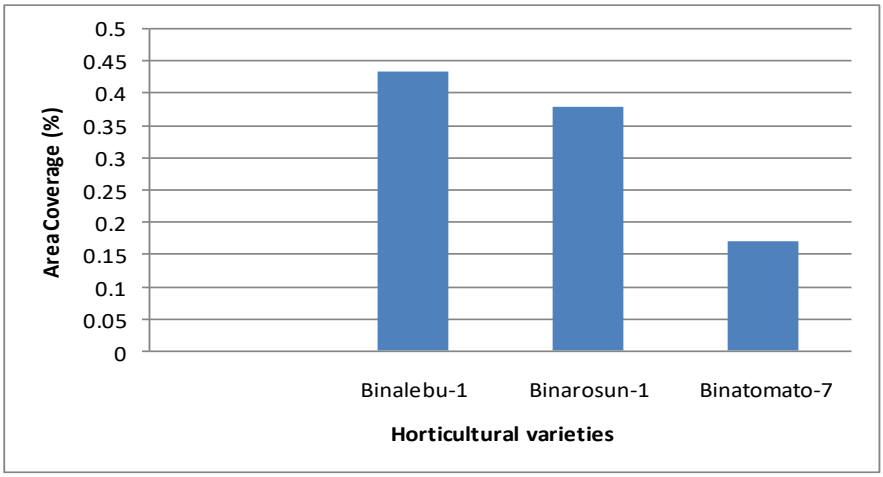

Fig. 9. Variety-wise area coverage of horticultural crop varieties during 2021-22

From Table 8, it was revealed that, among the 14 regions the highest area coverage for horticultural crop varieties was found 333.00 ha (45.26%) in Mymensingh agricultural region (region-2) and the lowest was found 4.50 (0.61%) ha in Dinajpur region (region-9). It was also observed that, among the 14 agricultural regions the highest area coverage for Binalebu-1 and Binatomato-7 were found in Mymensingh agricultural region (region-2) about 210.00 ha (61.27%) and 48.00 ha (80.00%), respectively. But the highest area coverage for Binarosun-1 was found 198.00 ha (59.46%) in Rajshahi agricultural region (region-7).

The study identified some overall constraints and suggestions to increase area coverage of BINA developed varieties such as-Non availability of seed which was ranked I; followed by Lack of training facilities (rank II); Lack of demonstrations of BINA developed different varieties to the farmers (rank III); Lack of publicity of BINA developed varieties (rank IV); Lack of arranging Field Day & Regional Workshop (rank V); Lack of proper knowledge about BINA developed varieties of the farmers (rank VI); Lack of proper coordination with DAE, BADC & BINA (rank VII); and Lack of monitoring activities of BINA for the extension of BINA developed varieties (rank VIII) (Table 9).

Table 8. Region-wise adoption of BINA developed horticultural crop varieties during 2021-22

Region	Binalebu		Binarosun		Binatomato		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Reg-1	12.00	3.50	0.00	0.00	0.00	0.00	12.00	1.63
Reg-2	210.00	61.27	75.00	22.52	48.00	80.00	333.00	45.26
Reg-3	9.00	2.63	60.00	18.02	0.00	0.00	69.00	9.38
Reg-4	15.00	4.38	0.00	0.00	0.00	0.00	15.00	2.04
Reg-5	6.00	1.75	0.00	0.00	0.00	0.00	6.00	0.82
Reg-6	5.25	1.53	0.00	0.00	0.00	0.00	5.25	0.71
Reg-7	9.00	2.63	198.00	59.46	12.00	20.00	219.00	29.77
Reg-8	15.00	4.38	0.00	0.00	0.00	0.00	15.00	2.04
Reg-9	4.50	1.31	0.00	0.00	0.00	0.00	4.50	0.61
Reg-10	9.00	2.63	0.00	0.00	0.00	0.00	9.00	1.22
Reg-11	12.00	3.50	0.00	0.00	0.00	0.00	12.00	1.63
Reg-12	16.50	4.81	0.00	0.00	0.00	0.00	16.50	2.24
Reg-13	10.50	3.06	0.00	0.00	0.00	0.00	10.50	1.43
Reg-14	9.00	2.63	0.00	0.00	0.00	0.00	9.00	1.22
Total	342.75	46.59	333.00	45.26	60.00	8.15	735.75	100.00

Source: DAE data, 2021-22

Note: **Reg-1:** Cumilla region, **Reg-2:** Mymensingh region, **Reg-3:** Sylhet region, **Reg-4:** Rangamati region, **Reg-5:** Khulna region, **Reg-6:** Barishal region, **Reg-7:** Rajshahi region, **Reg-8:** Rangpur region, **Reg-9:** Dinajpur region, **Reg10:** Bogura region, **Reg-11:** Dhaka region, **Reg-12:** Chattogram region, **Reg-13**: Jashore region, and **Reg-14:** Faridpur region.

Some suggestions were also identified for expanding BINA variety cultivation, the highest suggestion was ensuring adequate seeds in every season at appropriate time which was ranked I; publicity & demonstration are needed to popularize BINA developed varieties among the farmers through DAE & BADC (rank II); arrangement of proper training to build proper conception about BINA developed varieties & technologies for the DAE personnel, extension workers & farmers (rank III); arrangement of more Field Day and distribution of leaflets & booklets (rank IV); ensuring proper coordination & strong linkage among DAE, BADC, BINA & farmers (rank V); more productive & location specific varieties should be developed (rank VI); research Extension Linkage of BINA should be strong (rank VII) and ensuring proper monitoring activities by BINA for the extension of BINA developed varieties (rank VIII).

Table 9. Constraints and suggestions by DAE personnel

Item	No. of respondent	Percentage	Rank
Constraints			
Non availability of seeds	30	30.61	I
Lack of publicity of BINA developed varieties	11	11.22	IV
Lack of proper knowledge about BINA developed varieties of the farmers	8	8.16	VI
Lack of training for DAE personnel, extension workers & farmers	18	18.37	II
Lack of demonstrations of BINA developed different varieties to the farmers	12	12.24	III
Lack of proper coordination with DAE, BADC & BINA	6	6.12	VII
Lack of monitoring activities of BINA for the extension of BINA developed varieties	3	3.06	VIII
Lack of arranging Field Day & Regional Workshop	10	10.20	V
Suggestions			
Ensure adequate seeds in every season at appropriate time	30	27.27	I
Publicity & demonstration are needed to popularize BINA developed varieties among the farmers through DAE & BADC	22	20.00	II
Arrange proper training to build proper conception about BINA developed varieties & technologies for the DAE personnel, extension workers & farmers	18	16.36	III
Ensure proper coordination & strong linkage among DAE, BADC, BINA & farmers	8	7.27	V
Ensure proper monitoring activities by BINA for the extension of BINA developed varieties	4	3.64	VIII
More productive & location specific varieties should be developed	6	5.45	VI
Research Extension Linkage of BINA should be strong	5	4.54	VII
More Field Day should be arranged and distribute leaflets & booklets	17	15.45	IV

Source: DAE data, 2021-22

Conclusion

Area coverage BINA developed variety is increasing day by day and replacing traditional varieties. For continuation of variety expansion, the institute should ensure quality seed supply in proper time through strengthening strong collaboration with BADC, DAE & NGO's. Finally, sufficient number of training, workshop/seminar, demonstration, field day and its budget should be increased which will support in food production as well as minimize the future hazard of climate change for ensuring food and nutritional security.

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