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BARI Annual Report 2017-18

Bangladesh Agricultural Research Institute
Joydebpur, Gazipur-1701

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Published by
Bangladesh Agricultural Research Institute (BARI)
September, 2018
800 Copies

Printed at
Rita Art Press
13/Ka/1/1, K. M. Das Lane
Wari, Dhaka-1203
Phone: 47112756

The correct citation for this reports:
BARI (Bangladesh Agricultural Research Institute) 2018
Annual Report (2017-2018), BARI, Gazipur

Foreword

This annual report includes the major findings of the experiments conducted by the scientists of different Crop Research Centers and Research Divisions of BARI during the year 2017-18. The major research areas include variety development of different crops, such as cereals (wheat, maize, millet, barley and sorghum), tubers (potato, sweet potato, aroids etc.), oilseeds (mustard, rapeseed, groundnut, sunflower, safflower, linseed, niger etc.), pulses (grasspea, lentil, chickpea, mungbean, blackgram, cowpea, pigeonpea etc.), horticultural crops (fruits, vegetables and flowers), and spices (onion, garlic, turmeric, ginger, fenugreek, etc.). The area of research also include improvement of cropping systems, crop, soil, water and irrigation management, plant nutrition, disease and insect management, production economics, development of low-cost farm machineries, postharvest processing, and farm management. Besides, attention was focused on adaptation and mitigation of climate change, plant biotechnological research, improvement of floriculture and hill farming. Our scientists have also engaged in developing technologies which are appropriate as well as sustainable with a view to narrowing the ongoing gap between current food demand and its production in the country.

The annual report summarizes all the research activities of this year. But it is really very hard to accommodate all the findings of all the studies in such a single volume. So like previous years, only the major findings of the studies have been incorporated in this report. The readers can get the information about any of the studies in brief. In case, anybody wants to have all the generated data, he or she may go through the centre or divisional reports.

I sincerely thank and appreciate the scientists, editors and associates who have worked hard to publish the report. I hope this report will be very useful to the scientists, teachers, students, policymakers and other stakeholders who have engaged in agricultural research and development in Bangladesh.

Dr. Abul Kalam Azad
Director General, BARI

Bangladesh Map
Central Station
Regional Station
Research Centre
Sub Station
SP. Crop Station
North
INDIA
INDIA
INDIA
MYANMAR
B A Y O F B E N G A L
PANCHAGARH
NILPHAMARI
LALMONIRHAT
THAKURGAON
DEBGANJ
BURIRHAT
NASHIPUR
DINAJPUR
KURIGRAM
RANGPUR
MAHIGANJ
GAIBANDHA
JOYPURHAT
SHERPUR
NAOGAON
SHIBGANJ
BOGRA
JAMALPUR
SUNAMGANJ
SYLHET
NETRAKONA
NAWAB GANJ
KAZLA
RAJSHAHI
NATOR
ISHURDI
SIRAJGANJ
TANGAIL
MYMENSINGH
HABIGANJ
MOULVIBAZAR
AKBARPUR
KISHOREGANJ
JOYDEBPUR
GAZIPUR
NARSINGDI
PABNA
MEHERPUR
KUSHTIA
MANIKGANJ
DHAKA
N'GANJ
BRAHMANBARIA
CHUADANGA
RAJBARI
JHENAIDAH
MAGURA
FARIDPUR
MUNSHIGANJ
COMILLA
KHAGRACHARI (HILL TRACTS)
SARIATPUR
CHANDPUR
JESSORE
NARAIL
MADARIPUR
GOPALGANJ
BARISAL
LAXMIPUR
NOAKHALI
FENI
HATHAZARI
RANGAMATI (HILL TRACTS)
PAHARTALI
RAIKHALI
CHITTAGONG
KHULNA
PEROJPUR
RAHAMATPUR
JHALAKATI
BAGERHAT
PATUAKHALI
BHOLA
BARGUNA
BANDARBAN (HILL TRACTS)
COXS BAZAR
0 10 20 30 40 50 miles
0 20 40 60 80 km

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CHAIRMAN

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Member

Two eminent scientists, one in social science and other in the field pertaining to the speciality of the Institute (nominated by the Ministry or the Division dealing with agriculture)

A representative of the Council (nominated by the Council)

The Directors of the Institute (Ex-officio)

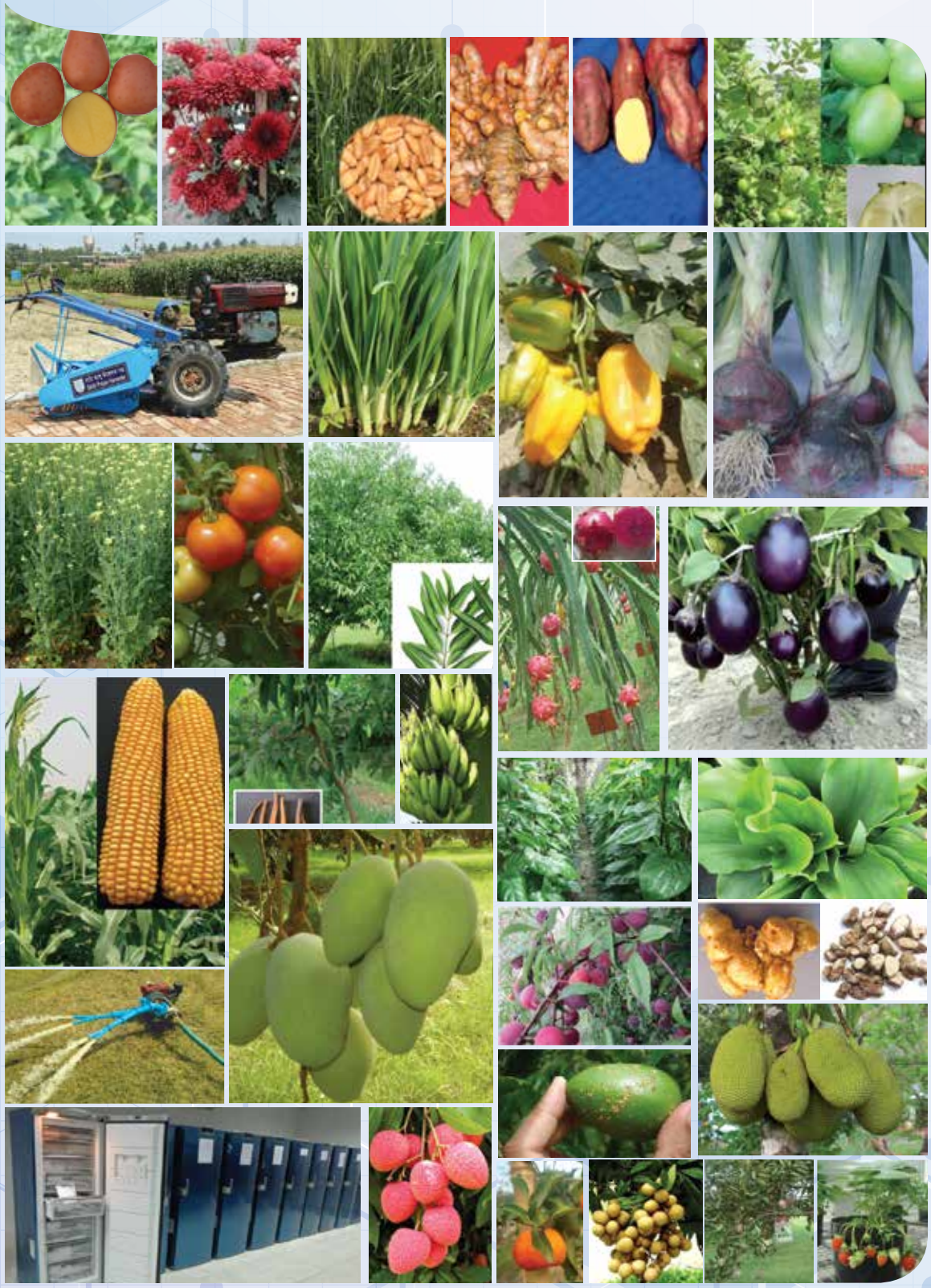
Two senior scientists of the Institute (nominated by the Ministry or the Division dealing with agriculture)

A representative of the DAE not below the rank of Director (nominated by the Ministry)

Two representatives, one from the Ministry or the Division dealing with agriculture and the other from the Finance Division not below the rank of Deputy Secretary (nominated by the respective Ministry or Division)

Two representatives, one from among the farmers and the other from among the non-Govt. Organizations (NGOs) performing functions similar to those of the Institute (nominated by the Ministry or Division dealing with agriculture)

The Director-in-charge of administration of the Institute acts as secretary of Board.



CONTENTS

Foreword

Board of Management

Cereal Crops

Wheat 01
Maize 30
Barley 38
Millet 40
Kaon 41
Sorghum 41
Buckwheat 41
Oat 41

Tuber Crops 42

Pulse Crops

Blackgram 66
Lentil 67
Chickpea 73
Grass pea 74
Felipe 76
Cowpea 77
Fababean 77
Pigeonpea 77
Mungbean 77

Oilseed Crops

Rapeseed and Mustard 82
Sesame 86
Groundnut 86
Soybean 88
Sunflower 89
Linseed 89
Niger 90
Safflower 90

Spice Crops

Onion 97
Garlic 104
Chilli 106
Ginger 112
Turmeric 115
Black cumin 116
Fenugreek 116
Dill 118
Celery 119
Ajwan 119
Cumin 119
Akangi 121
Chive 121
Bay leaf 122
Betel leaf 122
Black pepper 123

Vegetable Crops

Eggplant 124
Tomato 130
Capsicum 137
Cauliflower 139
Cabbage 140
Broccoli 141
Bottle Gourd 142
Pumpkin 143
Bitter gourd 145
Sponge Gourd 146
Ridge Gourd 147
Teasle Gourd 147
Cucumber 147
Ash Gourd 148
Squash 148
Pointed Gourd 148
Water Melon 148
Muskmelon 149
Netted Melon 149
Country Bean 150
Yard Long Bean 151
French Bean 152
Garden Pea 152

Okra 152
Stem Amaranth 153
Spinach 154
Indian Spinach 155
Spinach 155
Indigenous Vegetables 156
Drumstick 156
Upland Vegetables 157
Mushroom 158

Fruit Crops

Jackfruit 163
Mango 165
Banana 167
Litchi 169
Guava 170
Ber 170
Papaya 172
Shahi Papaya 172
Shahi Pepe 172
Pineapple 173
Sweet Orange 173
Lemon 174
Pummelo 175
Citron 177
Sapota 178
Golden Apple 178
Bael 178
Jamun 179
Wax Jambu 180
Custard Apple 181
Burmese Grape 181
Indian dillenia 182
Cashewnut 185
Dragon Fruit 185
Jaboticaba 186
Strawberry 186

Flower Crops 201

Agronomy 207

Irrigation and Water Management 236

Farm Machinery 248

Agricultural Economics 258

Plant Genetic Resources 264

On-Farm Studies 269

Plant Pathology 331

Plant Physiology 349

Seed Technology 353

Vertebrate Pest 357

Postharvest Technology 361

Biotechnology 367

Soil Management 371

Entomology 392

Hill Agriculture 399

Service of ASICT 407

Training & Communication Wing 413

Planning & Evaluation Wing 415

Budget 426

Information Report (As per Information Commission Requirements) 428

Wheat

Variety development

The main objective of this programme is to develop high yielding bread wheat, durum wheat and triticale varieties with tolerance/resistance to biotic and abiotic stresses and having wide range of adaptability with a view to enhance wheat productivity in Bangladesh. Development of heat tolerant and wheat blast resistant variety has been given the highest research priority under the context of global climate change. Due emphasis has also been given to develop varieties against other abiotic stresses like drought, salinity, boron-deficiency, etc. Genetic improvement through incorporating stress adaptive traits into good agronomic background is being duly emphasized in the variety development programme. In addition, research thrust has been put forward towards developing varieties with improved nutritional quality. Efficient deployment of resistance genes into the genotypes with good agronomic background for major diseases like leaf rust, bipolaris leaf blight, stem rust, etc. is also considered as a priority area. The performance of newly developed wheat lines from national and international sources specially CIMMYT is being evaluated under different growing environments across the country and promising lines superior to the standard check varieties are selected.

Apart from that, WRC maintains a unique cross block having germplasm from diverse sources those are utilizing for hybridization. Segregating generations are advanced following selected bulk method. Every year hundreds of new lines are being added in the nurseries/trial for performance evaluation. Wheat research activities on variety development during 2017-18 are described in this report.

Hybridization

In order to enhance wheat production in the country, it is important to increase the yield potentiality and resistance to diseases of the upcoming varieties which can be achieved through good agronomic management. Yield potential can be increased through strategic crosses based on pyramiding yield potential traits, disease resistance, physiological traits conferring tolerance to abiotic stresses, etc. in the agronomical superior adapted genotypes. Thus, main objective of hybridization is to create variability by combining and recombining desirable genes in the background of different adapted genotype. This will be further followed up through selection of desirable plants in subsequent generations to develop improved varieties.

A total of 483 single, 29 top and 45 back crosses were made at three research stations aiming at developing heat tolerant, short height, early maturing cultivars resistant or tolerant to BpLB, leaf/stem rust, specially Ug99 stem rust and wheat blast by recombining/transferring genes to the good agronomic background. The hybridization programme wae conducted at Dinajpur, Joydebpur and Jamalpur. The F_1 seeds will be confirmed in next year.

Confirmation and selection in F_1 generation

The objective of this nursery was to confirm F_1 hybrids in respect to their female parents and to obtain seed for growing F_2 generation in the next season from the selected F_1 population.The nursery consisted of single, top and back cross F_1 hybrids along with female parents. F_1 hybrids along with female parents were sown on 20-30 November 2017 in the experimental farms of WRC at Dinajpur, Joydebpur, Jamalpur and Rajshahi. Altogether 459 F_1s derived from single crosses have been confirmed as F_1 hybrids on the basis of phenotypic expression of hybrids with their respective female parents from different locations. Moreover, 35 top cross and 46 back cross derived F_1 populations were selected as hybrids. Each F_1 hybrid was will be grown as F_2 population in the next season. A total of 540 F_1 hybrids selected from different stations will be grown as F_2 generation

under space planted condition next year to select desired genotypes.

Evaluation and selection in different filial generations

The success of a hybridization programme depends on careful handling of segregating generations. It is often desirable to discard poor cross-combinations in early generation, so that adequate attention can be paid to really potential combinations. The main objective of handling segregating generations is to grow and select the desirable families and individual plants in different filial generations for further evaluation.

A total of 663 (Din-202, Joy-203, Jess-123, Jam-75 and Raj-60) F_2 families were evaluated and 344 families (Din-101, Joy-57, Jam-47, Raj-67 and Jess-72,) were selected over the locations. A total of 421 F_3 (Din-133, Joy- 101, Jess-55, Jam-73, Raj-59) families and 214 F_4 (Din-35, Joy-29, Jess-36 Jam-82, Raj-32) were evaluated and 172 F3 (Din-351, Joy-29, Jam-25, Raj-39, Jess-28) and 126 F4 families (Din-24, Joy-21, Jam-32, Raj-26, Jess-23) were selected, respectively. A total of 190 F_5 Families (Din-29, Joy-17, Jess-35, Raj-29, Jam-80) were evaluated and 118 F5 families (Din-24, Joy-11, Jam-34, Raj-24 and Jess-25) were selected from where 1118 individual plants (Dinajpur-300, Joydebpur-87, Jamalpur-334 , Raj-147 and Jess-250) were collected. A total of 217 F_6 (Din-90, Joy-23, Jam-68, Raj-18 and Jes-18) plant row families out of 815 were selected for further evaluation through BWSN in next year. All the individual plants and families were selected good agronomic performance in the field, disease tolerance and excellent visual grain characteristics. The selected families, individual plants and whole plots from different generations will be grown at each station in next season to select the promising ones for advancing the generations following selected bulk method.

Germplasm maintenance

One hundred seventy two wheat genotypes with special characteristics were selected from different trials and nurseries of various years but not recommended as varieties are maintained through this nursery. Different exotic genotypes with special features are also included in this nursery. Each entry was grown in 2.5m long 3 rows. The nursery was planted under irrigated timely sown condition at WRC, Dinajpur following recommended package of agronomic practices. The materials with special characrers are maintening in this nursery for future use.

Bangladesh wheat screening nursery (BWSN)

Bangladesh Wheat Screening Nursery is an important nursery of wheat breeding program of WRC. The selected genotypes from national nurseries like Heat Tolerant Screening Nursery and international nurseries and trials are included in this nursery. All the materials of this nursery are evaluated in this nursery before testing in yield trials. The objectives of this nursery were to select high yielding, disease resistance, short stature, and early maturing suitable genotypes for inclusion in preliminary yield trial.

In the BWSN-1, sixty genotypes selected from last year's F_6 were included in this nursery along with Shatabdi and BARI Gom-32 as check varieties. The experiment was conducted under irrigated timely seeding (ITS) and irrigated late seeding (ILS) conditions at WRC, Dinajpur, Jashore and RWRC, Joydebpur. The higher yield was recorded in ITS condition (4988 kg ha^{-1}) than ILS condition (3019 kg ha^{-1}). The highest yield (4851 Kg ha^{-1}) was recorded in Dinajpur which was significantly higher than Jashore and Joydebpur. Yield of Jashore and Joydebpur were significantly lower compare to Dinajpur. The highest yield was recorded in E-37 (4395 Kg ha^{-1}). The significant interaction effect for location, seeding time and genotype, was observed for heading and maturity days. The highest heading days was recorded in check variety Shatabdi (74 days) and the lowest heading days was recorded in check BARI Gom-32 (52) at Joydebpur under ITS condition. The highest maturity days was recorded in E-21 (117 days) at Dinajpur in ITS condition. The lowest maturity days was recorded in E-21 (81) at Joydebpur under ILS condition. All the lines produced higher grain yield under ITS than ILS conditions. The highest yield under ITS condition was recorded in E-14 (7600 kg ha^{-1}) followed by E-25 (7567 kg ha^{-1}) at Dinajpur whereas at Jashore in E-21 (5008 kg ha^{-1}) and at Joydebpur in E-57 (4403 kg ha^{-1}). The lowest yield under ILS condition was recorded in E-60 (2540 kg ha^{-1}), E-14 (2180 kg ha^{-1}) and check shatabdi (2690 kg ha^{-1}) at Dinajpur, Joydebpur and Jashore respectively. The highest yield loss due to late seeding (48%) was recorded in E-57 among the selected genotypes and the lowest yield loss (26%) was recorded in E-40 followed Based on overall performances 15 genotypes viz. E-11, E-14, E-15, E-21, E-23, E-25, E-29, E-37, E-40, E-42, E-47, E-

49, E-55, E-57 and E-60 were selected for inclusion in PYT next year.

In BWSN-2 eighty genotypes mostly selected from last year's F_6 and selected lines of international trials. The experiment was conducted under irrigated timely seeding (ITS) and irrigated late seeding (ILS) conditions at WRC, Dinajpur, Rajshahi and Jashore. The performance of all genotypes, seeding times, locations and their different levels of interactions were statistically significant for different traits. All the selected genotypes headed and matured earlier than the check variety Shatabdi. The highest TGW was recorded in E-73 (54.4g) at Dinajpur in ITS condition and the lowest TGW was recorded in E-48 and E-74 (33g) at Dinajpur in late sown and at Jashore both in ITS and ILS conditions. The highest yield (7220 kg/ha) was recorded in E-20 under ITS and the lowest yield (3583 kg/ha) was recorded in E-68 followed by E-23 and E-39 under ILS condition at Dinajpur. The highest yield loss due to late seeding was recorded in E-80 (49%) and the lowest yield loss was recorded in E-46 (34%). Based on overall performances 12 genotypes viz. E-3, E-4, E-6, E-17, E-21, E-24, E-46, E-48, E-73, E-74, E-77 and E-80 were selected for inclusion in PYT next year.

Preliminary yield trial (PYT)

After passing Bangladesh Wheat Screening Nursery, the advance lines are tested for yield over locations in different growing conditions. Therefore, assigned Preliminary Yield Trial was conducted to evaluate the performance of the advance lines compared to the existing check varieties and select the promising lines for inclusion in the Advance Yield Trial (AYT) next year. The trial was conducted at Dinajpur, Joydebpur and Jessore with 20 promising lines selected from BWSN I and BWSN II last year (2016-17). Shatabdi, BARI Gom-21, BARI Gom-32 were used as checks.

Days to heading, maturity, plant height, spikes m^{-2}, thousand grain weight (TGW) and grain yield were significantly influenced by the seeding times. Values for all the traits were higher at Dinajpur than Jessore and Joydebpur. The average yield was highest at Dinajpur than other two locations. All the selected genotypes headed and matured earlier than the check variety Shatabdi. Majority of the genotypes produced higher grain yield than check variety Shatabdi. The highest yield was recorded in BAW 1325 (3976 kg ha^{-1}) and identically followed by BAW 1324 and BARI Gom-32 (3926 kg ha^{-1}). The lowest grain yield was recorded in BAW 1331(3030 kg ha^{-1}). Thousand grain weight ranged from 36.1 to 47.7 g. All the selected entries produced higher TGW than Shatabdi. Most of the entries had lower spikes m^{-2} than Shatabdi. Among the selected entries, BAW-1337, 1338 had higher spikes m^{-2} than Shatabdi and BAW-1329 had higher spikes m^{-2} than BARI Gom-32. The mean performance of the genotypes was presented in Table 1.1.7.4. All the selected genotypes headed and matured earlier than the check variety Shatabdi. Majority of the genotypes produced higher grain yield than check variety Shatabdi. The highest yield was recorded in BAW 1325 (3976 kg ha^{-1}) and identically followed by BAW 1324 and BARI Gom-32 (3926 kg ha^{-1}). The lowest grain yield was recorded in BAW 1331(3030 kg ha^{-1}). Thousand grain weight ranged from 36.1 to 47.7 g. All the selected entries produced higher TGW than Shatabdi. Most of the entries had lower spikes m^{-2} than Shatabdi. Among the selected entries, BAW-1337, 1338 had higher spikes m^{-2} than Shatabdi and BAW-1329 had higher spikes m^{-2} than BARI Gom-32. The highest TGW (60.9g) was achieved in BAW 1328 in ITS conditions at Dinajpur followed by BAW 1333(60.4 g) and BAW 1333 (58 g) in same location and seeding time. The lowest TGW (23 g) was obtained in ILS conditions at Jessore. The TGW for all genotypes were higher in ITS condition compare to ILS condition over all three locations. The TGW gradually decreases significantly with the delayed seeding. The grain yield gradually decreased significantly with the delay of sowing times at two locations viz Joydebpur and Jessore. Grain yield was ranged from 1501 to 6312 kg ha^{-1}.The highest grain yield (6312 kg ha^{-1}) was obtained in BARI Gom-32 at Dinajpur under ITS condition. The lowest grain yield (1501kg ha^{-1}) was obtained in BAW 1331at Jessore under ILS condition. Lower yielding ability of the genotypes at Jashore in late seeding condition was due to wheat blast.The highest yield loss (54%) due to late seeding (Table 1.1.7.8) was recorded in BAW 1326. The lowest yield loss (2%) were recorded in BAW 1717 followed by BAW 1716 (9%). Considering the overall performance, 9 genotypes BAW 1321, BAW 1322, BAW 1323, BAW 1326, BAW 1327, BAW 1328, BAW 1329, BAW 1330 and 1338 were finally selected for testing in AYT next year.

Advance yield trial (AYT)

The selected outstanding genotypes from Preliminary Yield Trial are included in this trial for further evaluation across different agro-ecologic conditions to confirm the stability over the environments in respect to grain yield, disease reaction, etc. Therefore, the objective of this trial was to evaluate the performance of the advance lines compared to the existing varieties and select the promising lines for further evaluation in multi-location trials at farmers' field. The trial was conducted with eleven promising lines selected from PYT 2016-17. Shatabdi, BARI Gom-26 and BARI Gom-32 were used as checks. The experiment was laid out in RCB factorial design with three replications at six locations (Dinajpur, Joydebpur, Jessore, Jamalpur and Rajshahi) under ITS and ILS conditions. The genotypes were evaluated for yield and yield components. The significant variations were observed for all the traits influenced by the seeding time. Days to maturity were earlier at late sowing condition. The number of spikes m^{-2} was significantly higher at ILS condition. The TGW was higher at ITS condition compared to ILS conditions. The higher yield was achieved under ITS than ILS condition.

The effect of locations on yield and other related traits showed that the height yield was achieved at Dinajpur (4099 kg ha^{-1}) followed by Joydebpur (3741 kg ha^{-1}) . The lowest yield was recorded at Jamalpur (3108 kg ha^{-1}). Earlier heading, maturity, shorter plant with lower number of spikes m-2 was recorded in Joydebpur. All the tested genotypes headed and matured earlier than the check variety Shatabdi (Table 1.1.8.4). The highest spike m^{-2} was recorded in BAW1290 which was statistically higher than all three check variety. Out of eleven genotypes tested ten had higher 1000-grain weight than all three check varieties. The highest 1000-grain weight was recorded in BAW 1293 followed by BAW 1317 and BAW 1303. The lowest 1000-grain weight was showed in check variety Shatabdi. All the selected genotype out yielded than all three check variety. The highest yield was achieved in BAW 1290, followed by BAW 1318 and BAW 1317. The effect of seeding time, genotypes and their interactions over locations on TGW and grain yield showed that the highest TGW was recorded in BAW 1293 (65.3 g) and BAW 1307(63.8 g) at Dinajpur followed by and BAW 1293 (60.01g) at Joydebpur, (57.7 g) at Jeshore, (59.9 g) at Rajshahi and (60.5 g) at Jamalpur under ITS condition. The lowest TGW was recorded in BARI Gom-21 (25.7 g) at Jessore under ILS condition. The highest yield was achieved in BARI Gom-32 (6024 kg ha^{-1}) followed by BAW 1290 (5755 kg ha^{-1}), BAW 1318 (5714 kg ha^{-1}) under ITS condition and the lowest yield was achieved in BARI Gom-21(2413kg ha^{-1}) under ILS condition at Dinajpur. In Joydebpur location the highest yield was recorded in BAW 1290(4713 kg ha^{-1}) under ITS and the lowest yield was recorded in BAW 1295(3101 kg ha^{-1}) under ILS condition.In Jeshore the highest yield was recorded in BAW 1317(4921 kg ha^{-1}) under ITS condition and the lowest yield was achieved in BARI Gom-26 (1826 kg ha^{-1}) under ILS condition. The highest yield was achieved in BAW 1317 (5192 kg ha^{-1}) at Rajshahi under ITS condition and the lowest yield was recorded in BARI Gom-26 (2575 kg ha^{-1}) under ILS condition at the same location. The highest yield was observed in BAW 1317(4062 kg ha^{-1}) at Jamalpur under ITS condition and the lowest yield was achieved in BAW 1297(2176 kg ha^{-1}) under ILS condition at the same location. All the advanced lines showed similar yield losses like check variety BARI Gom-32 under ILS condition. Considering the overall performance four genotypes viz BAW 1290, BAW 1297, BAW 1317and BAW 1318 were finally selected for further evaluation in candidate variety trials next year.

Candidate variety demonstration (CVD)

The advance lines are usually tested in comparatively larger plots in on-station under optimum and late seeding conditions before on farm testing. Therefore, to select genotypes for Farmers' Field Trial at MLT sites, the trial was conducted to evaluate the performance of the advance lines against the check varieties BARI Gom-21(Shatabdi) and BARI Gom-32. Eight promising candidate varieties were evaluated in this trial against the check varieties BARI Gom-21 and BARI Gom-32. The trial was conducted in optimum and late seeding conditions at Dinajpur and Jessore during 22 November (ITS) and 25 December (ILS), 2017 in non-replicated plots. The effect of seeding times revealed that all characters under study were significantly influenced by seeding time

Effects of genotypes, seeding time and their interaction over locations showed that there was no significant yield difference due to genotypes. The

highest yield was recorded in BAW 1208 (5940 kg ha^{-1}) in ITS condition followed by BAW1243 and BAW 1254. All the genotypes produced higher grain yield compare to both the check variety except BAW 1300 in ITS condition. The lowest yield was recorded in BAW 1300 (2628 kg ha^{-1}) in ILS condition. The highest blast infection was recorded in BAW 1243(70%) and the highest spike severity were observed in BAW 1208(80%) under inoculation condition. The lowest disease infection (1%) was recorded in BAW 1272. BAW 1280 and BAW 1300 Showed immunity incase of blast disease infection and severity. Considering the overall performance over locations, seeding times and genotypes and their different interactions on yield and other characters, plant stature, disease reactions, visual grain quality etc. the genotypes BAW 1208, BAW 1243, BAW 1254, BAW 1286, BAW 1147 and BAW 1300 could be tentatively selected for evaluation in same trial and MLT sites next year. BAW 1280 will be shifted in crossing block next year.

Genetic gain of wheat varieties in Bangladesh

Wheat is the second most important staple food crop in Bangladesh after rice and its consumption is increasing 10% per year. WRC has so far developed 33 wheat varieties till 2017. Rapid adoption of new varieties and other improved production technologies causing a substantial yield increase in recent years, and the ever highest national average yield of 3.10 t/ha. This yield increase was realized by significant contributions in both genetic values of the varieties used and improved agronomy, irrigation and fertilization. It is important to document the genetic gains in grain yield of recently released varieties under sprayed and unsprayed with Irrigated Timely Sown (ITS) conditions to assist in developing future breeding strategies. Eight wheat varieties (Sonalika, Kanchan, Shatabdi, Prodip, BARI Gom-26, BARI Gom-28, BARI Gom-30 and BARI Gom-32) were used in this study to evaluate their performance under sprayed (Fungicide) and unsprayed (control) conditions.

The mean effect for all traits were statistically significant. The lowest heading and maturity days were BARI Gom-32, which can escape terminal heat stress. The plant height also found lowest in BARI Gom-32 which prevent lodging. The highest number of spikes m^{-2} was recorded in Kanchan (492) followed by BARI Gom-28 and Shatabdi. The highest grain $spike^{-1}$ were found in Shatabdi followed by BARI Gom-26 and Prodip. The highest TGW was recorded in Prodip (57.8 g) followed by BARI Gom-32 (55.9 g) and BARI Gom-30 (51 g). The highest spikelet $spike^{-1}$ also recorded in Prodip. The highest yield was noted BARI Gom-26 (6384 kg ha^{-1}) followed by BARI Gom-28 (6112 kg ha^{-1}) and BARI Gom-30 (5821 kg ha^{-1}). The highest yield lose was recorded in Shatabdi (25%) for unsprayed condition which was released in 2000. The yield was higher under unsprayed condition in BARI Gom-32. The yield lose for unsprayed was lower in recently released wheat varieties (Prodip, BARI Gom-26, BARI Gom-28 and BARI Gom-30) than previously released wheat varieties (Sonalika, Kanchan, Shatabdi). The yield of sprayed wheat slightly higher ($y = 0.1838x - 315.16$) than unsprayed wheat ($y = 0.3123x - 576.75$).

5th early he at tolerance wheat screening nursery (5th EHTWSN)

A large amount of wheat growing lands become available for sowing in late October to early November due to expansion of short duration rice varieties. But seeding of wheat at this period has not been recommended yet. Temperature remains comparatively high at this period which has detrimental effect during germination and crop establishment stages causing considerable yield loss. Heat stress during early crop growth is called "Juvenile heat stress" which cause' less biomass. less tillering i.e. poor crop stand, shortened vegetative period i.e. early heading with less number of grains per spike and reduced spike length. Sometimes optimum sown wheat also suffers from early heat stress. Usually, farmers don't like to hold their land empty for long time to avoid loss of residual soil moisture. Variability for heat tolerance exists in spring wheat Development of early heat tolerant wheat line/variety has great potential to increase the area and productivity of wheat.

Fifteen high yielding advance lines including four check varieties Shatabdi, BARI Gom-26, BARI Gom-29 and BARI Gom-30 were evaluated in this trial. The experiment was conducted under irritated early seeding condition at two locations. In each location the experiment was planted in early sown irrigated condition to expose the crop to high temperature at early crop establishment. TGW and yield were high at Dinajpur site. Grain yield at Rajshahi and Dinajpur sites were 3731 kg ha^{-1} and 4559 kg ha^{-1} respectively. Such result might be due

to cooler environment in Dinajpur site and warmer in other sites. The selected high yielding genotypes will be further tested for their tolerance to early heat tolerance next year. The genotypes will be deliberately sown in the next year during end of October to first week of November to expose the crop to early heat.

Heat tolerant wheat yield trial (HTWYT)

A major constraint for wheat production in Bangladesh is late planting. Due to the late harvest of T. aman rice, it is mostly planted in mid to late December, 2-3 weeks after the optimal planting date. Due to late planting, growth and development particularly grain-filling is subjected to hot and humid climate at the second week of February which hasten grain filling period resulting shriveled grain and low yields. So, development of heat tolerant variety is an utmost priority. Therefore, the genotypes under High Temperature Wheat Yield Trial were screened to select promising heat tolerant lines that can be exploited in developing heat tolerant wheat variety. Twenty advanced lines along with check variety BARI Gom-21 and BARI Gom-32 were planted in Regional Agricultural Research Station (RARS), Jashore and WRC, Dinajpur under irrigated timely sown (ITS), irrigated late sown (ILS) and irrigated very late sown (IVLS) conditions. The trial was planted in alpha lattice design with two replications. The seeds of each entry were sown on 28 November 2017, 26 December 2017 and 3 January 2018 under ITS, ILS and IVLS conditions, respectively in Jashore. In case of Dinajpur, the trial was sown on 28 November 2017, 26 December 2017 and 5 January 2018 under ITS, ILS and IVLS conditions, respectively. Effect of sowing time was found significant for all the characters studied except spikes. Across two locations timely sown condition (ITS) was found suitable from all the characters studied. The genotypes showed significant difference in all the characters studied like heading days, maturity days, plant height, physical grain characteristics, disease reaction etc. All the genotypes headed and matured earlier than the check variety BARI Gom-21. Heading days ranged from 57 days to 68 days. Maturity ranged from 95 days to 102 days across sowing time and location. The spikes m^{-2} varied from 276 to 351. The highest number of The spikes m^{-2} was observed in the check variety. Thousand grain weight ranged from 36 g to 46.2 g. All the entries out yielded the check variety. The highest yield was recorded in E-11 (4439) and it was identically followed by E-20, 19 and 16. The lowest grain yield was found in the check variety Shatabdi (3723 kg/ha). Interaction effect of sowing time and genotype was found significant for all traits except for spikes m^{-2} and grain yield (Table 1.2.2.3). Ten entries showed less yield loss under ILS and 4 entries showed less yield loss under IVLS condition compared to check variety. There was no blast symptom found in optimum sown wheat crop. Late sown and very late sown crop have wheat blast infection in Jashore. Entry 4, 5, 10, 14, 18, 19 and 20 showed good level of resistance against wheat blast. Desired genotypes will be selected based on the visual grain quality and response to wheat blast. Nine entries (E-4, 9, 10, 11, 12, 14, 16, 19, 20) were selected based on yield performance in very late condition. The selected genotypes will be further tested in the next year for their tolerance.

5th Drought tolerant wheat yield trial (5th DTWYT)

Drought is an important production constrain in many tropical and subtropical environments including Bangladesh. Major wheat growing region of the developing world has identified heat and drought stress as the top research priorities to increase the productivity of wheat. Breeding efforts for the introduction and development of germplasm adapted to warm growing environments for many countries have been under taken. A total of 35 lines including two checks (viz. BARI Gom-28 and BARI Gom-30) were included in this trial. There were two experiments and crops were raised under rain-fed and irrigated timely sown (27 November, 2017) condition at RWRC, BARI, Shyampur, Rajshahi.

Grain filling was reterted under drought condition which causes 11.6% reduction compared to irrigated condition. Thus affected grain yield reduced by 19.03%. Long winter during the rabi season didnt affect much over crop phenology and stature. To screen the tested genotypes against drought Stress Tolerance Index (STI) was prepared for grain yield. On the basis of short duration and stature, grain characters, grain yield and STI index eight genotypes were selected among the tested 35. The selected entries E-8, E-11, E-12, E-15, E-17, E-19, E-23 and E-30 performed better under both environment and might have tolerance in drought stressed condition considering the yield, yield contributing traits and prepared index. These lines were suggested to grow in the next growing season for further evaluation.

Fund for the Institute was received from development and revenue budget of the Government of Bangladesh. The development budget was made available through the annual development program (ADP) for the on-going development projects under the Institute (Table 2). Out of total ADP allocation of Tk. 3478.35 lakh. The GoB funding was Tk. 3478.35 lakh, which was offered by different aid-giving agencies as Project Aid (PA).

Besides, an amount Tk. 27279.46 lakh was made available from the revenue budget to meet the recurring expenditure of the already complied projects of the Institute (Table).

Table-1: Budget provision of BARI for 2017-2018 (in lakh Tk.)

Total	GOB Head			Project Aid (PA/RPA	Capital Head	Revenue Head		Total
	ADP	Revenue	Total			ADP	Revenue	
30757.81	3478.35	27279.46	30757.81	0	804.49	2243.46	27255.90	29499.36

Table-2: Development Budget (Annual Development Programme) of BARI for 2017-2018 (in lakh Tk.)

No.	Name of Projects	Total	GOB	PA	Capital	Revenue		Total
						Pay & Allow.	Contingency	
	Development Projects							
1.	Citrus Development Project (BARI Part)	204.00	204.00	0	0	55.20	133.40	188.60
2.	Improvement and Quality Seed Production of Wheat and Maize-2nd Phase	314.50	314.50	0	36.50	0	245.29	245.29
3.	Strengthening of Oilseed and Pulses Research and Development in Bangladesh	596.00	596.00	0	132.00	30.93	320.25	351.18
4.	Strengthening Research on Horticultural Crops and Dissemination of Horticultural & Field Crop Technology at Charland Areas	1737.98	1737.98	0	416.99	0	1184.04	1184.04
5.	Research, Extension and Popularize of Vegetables and Spices Cultivation on Floating Bed	348.87	348.87	0	172.00	5.40	126.97	132.37

No.	Name of Projects	Total	GOB	PA	Capital	Revenue		Total
						Pay & Allow.	Contingency	
6.	Development and expansion of bio-rational based integrated pest management of vegetables, fruits and betel leaf (January 2018 to December 2021)	202.00	202.00	0	47.00	0	82.77	82.77
7.	Strengthening of Spices Crop Research in Bangladesh	75.00	75.00	0	0	0.85	58.36	59.21
	Total :	**3478.35**	**3478.35**	**0**	**804.49**	**92.38**	**2151.08**	**2243.46**

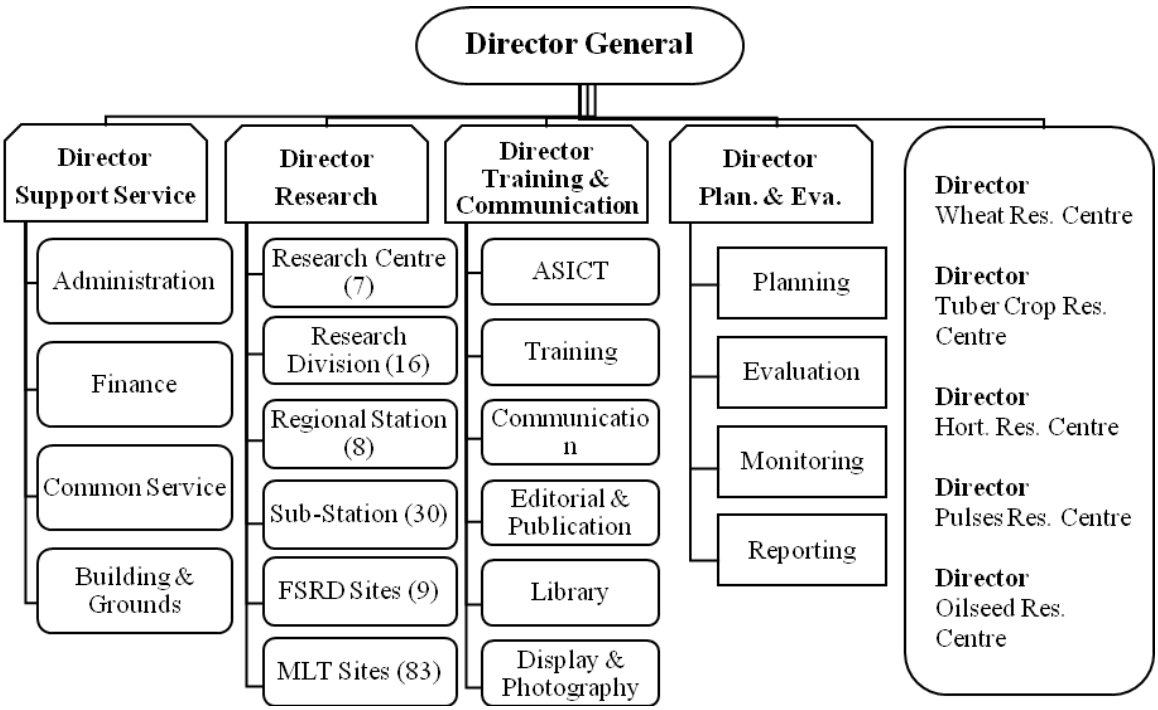
Institutional information:

BARI (Bangladesh Agricultural research Institute) is the largest multi-crop research institute conducting research on a wide variety of crops such as cereals, tubers, pulses, oilseeds, vegetables, fruits, spices, flowers, etc. Besides variety development, this institute carries out research on such areas as soil and crop management, disease and insect management, water management and irrigation, development of farm machinery, improvement of cropping and farming system management, post-harvest handling and processing, and socio-economic studies related to production, processing, marketing and consumption. The institute functions with the Director General as the chief executive along with three directors of its four major wings such as Research Wing, Support Service Wing, Training & Communication Wing and Planning & Evaluation Wing. The research Wing executes and monitors all the research programs and other research activities through 7 special crop research centers, 16 research divisions, 8 regional agricultural research stations and 30 sub-stations. Support Service Wing provides all the logistics support for research and personnel management. This wing is also responsible for infrastructural development and general procurement of the institute. The Training & Communication Wing is responsible for human resource development through conducting short term, mid tram as well as long term training and arranging scholarships for higher studies. Dissemination of information through print and electronic media, organizing seminars and symposia are also the important areas of activities of this wing. The Panning & Evaluation Wing is responsible for developing, executing, monitoring, evaluation of different projects.

BARI has a long historical background of its own. The emergence of the Institute in its present status has occurred through a number of changes starting from simply a sub-ordinate status under the Department of Land Records in the then Bengal. On the recommendation of the famine commission in 1880, the Bengal Department of Agriculture was established as a sub-ordinate part of the Department of Land Records in the then Bengal. In 1906, Lord Curzon, the then Vice Roy of India had granted separate status to the Bengal Department of Agriculture and in the same year, a Nuclear Agriculture Research Laboratory under this department was established at Tajgaon, Dhaka In 1908, an experimental station what has become known as Dhaka Farm was established on an area of 161.20 hectares of land. This Dhaka Farm was the predecessor of BARI and some other research institutes. Establishment of Dhaka Farm offered a good scope for conducting research in the field level in 1947, Bengal Department of Agriculture was renamed as East Pakistan Department of Agricultural. The two constituent divisions of the department were Research and Extension. In 1962, there was a severe blow to agriculture research when the land of Dhaka Farm was acquired for establishing Second Capital (today called Sher-e-Bangla Nagar). In 1968 two separate directorates were established – one was Directorate of Agriculture (Extension and Management) and the other was Directorate of Agriculture (Research and Education). The Directorate of Agriculture (Research and Education) was mostly concerned with research. This directorate was also responsible for the management of Bangladesh Agriculture Institute (BAI) at Sher-e-Bangla Nagar, Dhaka. Later in 1980s and 1990s, two other agriculture colleges, one in Patuakhali and the other in Dinajpur, were established. These two agriculture colleges were also administered by BARI until these became universities in 1971, the former provincial organization took on national responsibilities. Like many other sectors, agricultural sector inherited poor manpower and insufficient administrative set ups as well. Therefore, it was rightly thought to have established a coordinated and comprehensive research and some major decisions were taken up in 1973. Another important development in the year was the presidential Order No. XXXII that helps strengthen and reconstitute agricultural research organizations and system in the country. Upon subsequent developments of research institutions led to further restructuring in 1976,

through the presidential Order No. LXII, the Bangladesh Agricultural Research Institute (BARI) emerged as an autonomous and effective research organization following the dissolution of the Directorate of Agriculture (Research and Education) with sufficient operational flexibility, structural modification and improvement of regional and sub-stations.

Organizational Information:



Operational information:

Director General who is the Chief Executive of the institute has overall responsibility for administration, finance, development and execution of program related to research, manpower development, dissemination of information, transfer of technology and other extension activities. The Director General is assisted by four directors: Director (Research), Director (Support Service), Director (Training & Communication) and Director (Planning & Evaluation).

Director (Research) is responsible for program planning, monitoring and evaluation of the research activities as performed by the research centers, divisions and the regional and sub-stations.

Director (Support Service) is responsible for personal management, finance & accounts, procurement, infrastructure development, security, transportation and repair & maintenance.

Director (Training & Communication), on the other hand, is responsible for the transfer of technologies to the users through trainings, seminars, workshop, print & electronic media. Human resource development through training and arrangement scholarships for higher studies at home and aboard also fall within his responsibilities.

Director (Panning & Evaluation) is responsible for developing, executing, monitoring, evaluation of different projects under development budgets and Programmes (Karmosuchi) under revenue budget of GoB with the help of crop centers, sub-centers, divisions, Regional Agricultural Research Station (RARS) and Agricultural Research Station (ARS). Also involves in financial management, procurement activities, infrastructure development and arrange meetings like Project Implementation Committee (PIC), Project Evaluation Committee (PEC) of different projects and Planning & Development Committee (P&DC) meeting of the institute.

Each research division is headed by a Chief Scientific Officer (CSO) who is also designated as divisional head whereas a research center is headed

by a Director/Project Director. Each divisional head is assisted by the concerned scientist starting from Scientific Officer (SO) to Principal Scientific Officer (PSO). On the other head, each research center is comprised of scientists from various disciplines in the rank of Scientific Officer (SO) to Chief Scientific Officer (CSO).

Regional Stations are headed by senior scientist equivalent to the status of CSO, while the sub-stations are headed by the scientists in the rank of either PSO or SSO.

Information on Right to Information: RTI of BARI

Designated Officer	
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Website	: www.moa.gov.bd
Office	: Ministry of Agriculture (MoA), Dhaka

List of Information delivery to the citizen during 2017

ক্রমিক নং	কর্তৃপক্ষের নাম	তথ্য অধিকার আইন, ২০০৯ এর ফরমেট অনুযায়ী তথ্য সরবরাহের জন্য প্রাপ্ত আবেদনের সংখ্যা	তথ্য সরবরাহের মাধ্যমে নিষ্পত্তিকৃত আবেদনের সংখ্যা	অনুরোধকৃত তথ্য না দেয়ার সিদ্ধান্তের সংখ্যা ও উক্ত সিদ্ধান্ত গ্রহণের কারণ	দায়িত্বপ্রাপ্ত কর্মকর্তার সিদ্ধান্তের বিরুদ্ধে আপীলের সংখ্যা	আপীল নিষ্পত্তির সংখ্যা	কর্তৃপক্ষ কর্তৃক দায়িত্বপ্রাপ্ত কর্মকর্তার বিরুদ্ধে গৃহীত শাস্তিমূলক ব্যবস্থার সংখ্যা	তথ্য অধিকার (তথ্য প্রাপ্তি সংক্রান্ত) বিধিমালা ২০০৯ এর বিধি ৮ অনুযায়ী তথ্যের মূল্য বাবদ আদায়কৃত অর্থের পরিমান	কর্তৃপক্ষ কর্তৃক গৃহীত বিভিন্ন কার্যক্রমের বিবরণ	এন্তব্য
১	২	৩	৪	৫	৬	৭	৮	৯	১০	১১
১	বাংলাদেশ কৃষি গবেষণা ইনস্টিটিউট, গাজীপুর	২৫২ *২টি (তথ্য কমিশনের ফরমেট অনুযায়ী) *২৫০ টি (বিএআরআই এর ওয়েব পোর্টাল ও মোবাইল অ্যাপস হতে প্রাপ্ত ই-কৃষি সংক্রান্ত তথ্যের প্রশ্ন সংখ্যা)	২৫২ *২টি (তথ্য কমিশনকে জানানো হয়েছে) *২৫০ টি (বিএআরআই এর ওয়েব পোর্টাল ও মোবাইল অ্যাপস হতে প্রাপ্ত ই-কৃষি সংক্রান্ত তথ্যের উত্তর সংখ্যা)	-	-	-	-	-	-	-

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