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TEN YEARS OF DWARF WHEAT PRODUCTION IN BANGLADESH

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ABSTRACT

Available evidence on trends in wheat production and associated seed multiplication and distribution activities are reviewed. Impact of the introduction of dwarf wheat on production and the performance of the seed production and distribution systems are assessed.

1. INTRODUCTION

This is an opportune time to assess the impact of programmes for the expansion of wheat production in Bangladesh: It is ten years since first limited release of dwarf wheat in 1967/68 led rapidly to a programme for the expansion of wheat cultivation through the diffusion of dwarf wheat varieties. The expansion of wheat production has been complemented by programmes for development of research capacity in wheat, local wheat seed multiplication, and since 1975/76 the first halting steps in a price support programme through the procurement of wheat at local sales points at fixed prices from farmers.

This paper looks at the available evidence of trends in wheat production and associated seed multiplication and distribution activities. An attempt is made to assess the impact of the introduction of dwarf wheat on production and the performance of the seed production and distribution system at an aggregate level. This review is intended to be part of a larger review assessing the overall impact of programmes for the expansion of wheat production through investment in local research and development capacity including research and training links with CIMMYT, expansion of local seed production and distribution and extension efforts aimed at familiarising farmers with wheat cultivation.

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II. TRENDS IN WHEAT PRODUCTION 1947/48—1966/67

There was already an upward secular trend in wheat production in the two decades prior to the release of dwarf wheats of Mexican origin, initially in 1967/68 and on a larger scale in 1968/69 (Table 1). Traditional areas of wheat production existed in the western districts of Bangladesh, and the supply of wheat seed in emergency conditions after the Bengal famine of 1942/43 gave an impetus to production. Over the next two decades there was a modest but significant increase in wheat production resulting from both expansion of area and yields; but area expansion was the main factor in increased production (Table 2).

Part of the increase in yields can be attributed to improved varieties of wheat originating from the the partition Indian and post-partition Pakistani research programmes. At the time of the introduction of dwarf wheats, most varieties were locally farmer multiplied improved varieties. The few remaining so called *deshi* or local varieties which the author encountered in the study of four wheat blocks in Jessore District in 1975/76 were all said by the farmers to be of Punjabi origin, notably "P 52". Narvaez (1967) reports the following improved varieties of subcontinental and exotic origins having been released: IP-125, IP-152, India; DIRK, Australia; KONOZO, Japan; Tai-chung 32, Tai-chung 29, Taiwan.

III. TRENDS IN WHEAT PRODUCTION SINCE 1967/68

Official crop production estimates indicate a dramatic expansion in wheat production since 1967/78 when dwarf wheats were released on a very small scale for commercial production, and 1968/69 after the large scale distribution of Mexican dwarf wheat varieties. The earliest varieties released included Sonora 64, Lerma Rojo, and afterwards Mexipak (Kalyan Sona). In the 1970's the major varieties released have all been "short period" types including Sonalika, Tanori 71, Inia 66, Jupateco and Norteno.

There have been three phases in the expansion of wheat production since the release of the first dwarf wheats. During the years 1968/69 to 1970/71 the wheat area doubled as compared with the average of the period 1962—1967; there was a 30% rise in aggregate yields; production increased by approximately 150% (Tables 1, A2). During the aftermath of the Independence struggle, wheat production stagnated at close to the 1969/70 levels with a fall-off in production:

during the drought year of 1972/73. Since 1974/75, production has surged ahead again with a dramatic increase in area and yields associated with the intensive wheat production programme and large scale importation of seed for sale to commercial producers (Table 5).

A comparison of production trends before and after the introduction of dwarf wheat shows that the trend exponential rate of growth in yield had jumped from 1.2% to 6.6% a year, and the rate of expansion of area has risen from 3.4% to 5.1% a year with the trend rate of growth in production therefore rising from 4.5% to 11.7% (Table 2). The accelerated rate of area expansion is impressive as the base level in 1967/68 was double that of two decades earlier and the estimated annual increase in acreage in the last three years, including the present season, have reached the levels of 60, 24 and 55 thousand acres a year respectively.

The increase in officially estimated wheat yields is almost entirely accounted for by substitution of "HYV" for "local" varieties, with increased yields in "HYV" production accounting for only 5% of the increase in HYV wheat production (Table 2). According to the official statistics, this substitution is close to completion with HYV wheat accounting for 73% of wheat area and 89% of production in 1976/77 and provisionally estimated to account for 89% of wheat area and 96% of production in 1977/78 (Tables 3, A1). If the picture indicated by the official statistics is accepted then the scope for increased yield through substitution, seen in the growth in wheat production over the past decade, is almost exhausted : further yield increases would have to come from varietal improvement and intensification of the use of complementary inputs, particularly fertilizer and supplementary irrigation.

A closer review of other fragmentary evidence on production indicates that whilst the direction of change indicated by official statistics is broadly correct, the classification of HYV and local varieties and the implied precise chronology have to be interpreted with care. First, by 1975/76 both those undertaking micro studies of wheat production and those involved in evaluation of the HYV programme were finding that the earlier released "local varieties" had been almost entirely supplanted by dwarf wheat seed obtained from BADC, voluntary agencies, or seed multiplied by farmers for their own use and purchased on the open market. The distinction between HYV and local varieties has therefore been reinterpreted - HYV means wheat grown with seed obtained from official, or to a limited extent from voluntary agency, sources. Seed multiplied one or more times by the farmers and purchased on the open market is classified as "local". This change usage is implicitly confirmed by comparison with the change in

estimated area sown to HYV and the amount of seed distributed by BADC. Following the rule of thumb that one maund (38 kg) of seeds is used for one acre, then the annual change in HYV area is closely associated with the amount of seed distributed over the period 1975/76 - 1977/78.

As the greater part of wheat area is sown with seed multiplied by farmers (Table 4), there is enormous scope for rapidly switching varieties through selective multiplication, private exchange and sale, which has perhaps been overlooked because of the close association of HYV with official crop production programmes and distribution of seed. Even casual observation confirms, for there is no other more objective data available, that seed of varieties such as Sonora 64 and Lerma Rojo, where still encountered, has degenerated with repeated multiplication and the yield potential is much reduced. The inference is that the stage has already been reached when a regular supply of replacement seed is required to maintain yield and provide scope for further intensification. In view of the limitations of official statistics and the link between estimation of HYV acreage and official programmes for seed distribution, it is possible that the rate of expansion of wheat area has even been underestimated.²

A second problem concerning the official wheat statistics involves yield estimation. A comparison of official yield estimates with the limited evidence of micro studies of wheat production raises the possibility of overestimation of yields in official wheat statistics (Table 6). The estimates of yields under farmer level conditions are already close to those obtained in fertilizer trials with high levels of fertilizer use only adopted by a minority of farmers (H. Rahman, 1977) and the yields obtained on seed multiplication farms (Hashem, 1977). The aggregate yields are already high in comparison with estimated yields in other well established wheat areas, largely under irrigated conditions.³ Again, the doubts about yields indicate the need for careful work on yield determination to establish a fresh bench mark for wheat production after a decade of growth and diffusion of dwarf wheat varieties.

If there is substantial overestimation of yields and underestimation of wheat acreage, then there is still enormous scope for increased production through the application of known technology, with the upgrading of the general quality of seed used combined with the gradual increase in application of complementary inputs as farmers increase their knowledge of a still relatively unfamiliar crop.

IV. OTHER DEVELOPMENTS IN WHEAT PRODUCTION AND MARKETING

It is not possible within the limits of this brief statistical survey to review in detail other important developments in the wheat sector during the past few years. Nevertheless some of the issues with strong economic overtones can be briefly outlined. The seed industry and distribution system are especially important within the wheat sector because of the rapid rates of expansion of production and the continuing need for replenishing the stock of wheat seed. The high open market prices, reported from some areas in 1976/77 and again in 1977/78 up to 200% above the official seed price, indicates that there is considerable excess demand for the most popular varieties, notably Sonalika, and that this shortage of quality seed is probably a constraint on the expansion of production. The greater part of officially distributed seed is still imported. The BADC seed multiplication programme has made rapid progress with a growth rate of 18% over the past decade (Table 4), but still satisfies not more than 7% of seed requirements on the basis of official estimates of acreage and assuming a seed rate of 1 maund to 1 acre, which is lower than the recommended rates of seed application under most circumstances. The expansion of seed production to the 2000 tonnes envisaged under the World Bank supported programme for expansion of the seed multiplication farms will still only satisfy 12% of the annual seed requirement with the current acreage (World Bank, 1973). Without importation on the relatively large scale of 1975 and 1977 (Table 5) and / or involvement of the private sector on a large scale in the production of certified seed, it will not be possible to achieve high rates of replacement of farmer multiplied seed every third or fourth year that is necessary to maintain yield potential (See Biggs and Clay, 1975).

The high open market prices for wheat seed also raise questions about the efficiency and interpersonal and regional distributional implications of the current seed distribution system. First, the supply of seed at lower than market clearing prices subsidises those farmers who are engaged in seed multiplication for commercial sale, which may be desirable to encourage private multiplication of seed with present limited public sector capacity. Second, the allocation of a scarce input—quality seed—under conditions of "suppliers choice" raises questions about the efficiency effects of the regional allocation of seed. Third,

the high open market prices may explain the limited expansion of the certified growers programme in the past two years (Table 6). There have been opportunities for private storage and direct sale of seed to other growers.

Another important set of issues is concerned with the cost and returns of wheat production and the need for price support operations as implied by the decision to begin procurement in 1975/76. Whether wheat production is for commercial sale or domestic consumption, its rapid expansion indicates that production has been profitable at the prevailing constellation of input and output prices over the past few years. Further research is needed on the technoeconomics of wheat production and the marketing of local output. Some issues for investigation include: where and under what circumstances and at what prices would procurement to provide price support be justified? In what areas and at what prices would it be possible to draw more growers into production of certified seed for supply to the BADC distribution system?

V. CONCLUSIONS

The implementation of a sequence of programmes for the rapid expansion of wheat production through the diffusion of dwarf wheat varieties and components of a complementary package of inputs is one of the agricultural success stories of the past decade. A study of the evolution of these programmes is a testimony to the skill and confidence of the wheat scientists who recognise the scope for winter season wheat production in Bangladesh, which is close to the climatic limits for this temperate zone crop. This confidence is in marked contrast to the scepticism of planners and economists as reflected in the limited role assigned to wheat in the First Five Year Plan (Bangladesh, 1973) and earlier economic analyses of the potential for expanded wheat production reviewing progress up to 1973/74 (Biggs and Clay, 1975; R. Ahmed, 1976).*

The success of the wheat programme also reflects creditably on the policy makers who were willing to act on the advice of the agricultural scientists and provides another demonstration of the innovative capacity of the farmer where there are incentives and scope for increased productivity.

There is a need to establish more precisely what progress has been achieved with the wheat programme and to define a strategy for the more difficult phase, which begins when the scope for increased productivity through direct transfer of

technical knowledge will be more limited. In this new phase greater share of the burden of sustaining the wheat expansion programme will fall on local capacity for R & D and seed multiplication. Perhaps the most difficult issue at present is the dependence of the wheat programme on large scale import of seed. An early end to seed imports would reduce the impetus of the wheat production programme and possibly lead to a levelling out of production as experienced in the early 1970's. As any decision on this issue would have far-reaching implications, an evaluation of the costs and benefits of alternative strategies for the wheat sector should be undertaken in the approach period for the next Five Year Plan.

Notes :

1. N. Ahmed, 1976, describes the change in usage in Brahmanbaria Subdivision, Comilla District. The disappearance of the earlier varieties is confirmed in the discussion of the paper by M. Ahmed (1977) in BRRI (1977). The author also found that the earlier generations of wheat varieties had nearly disappeared in Jessore District in 1975/76 in an unpublished study of wheat cultivation. The HYV Task Force estimated the area under "HYV" at 76% as compared with the officially accepted Bureau of Statistics estimate of 59% (Table 3).

2. H. Brammer raised this issue after a field tour of North Bengal, February 1978, in which he found that the area under wheat had considerably expanded and encountered evidence of an active trade in wheat seed, itself an important institutional development in recent years.

3. The estimated yield of 17.6 mds/acre (1.6 tonnes/hectare) for 1976/77 and the provisional estimate of 21.2 mds/acre for 1977/78 would raise yields to levels exceeding those reported for most states of North India, excepting the Punjab and West Bengal. The latter is also a state with weakened capacity to collect reliable crop production statistics as a consequence of the political and agrarian disruption of the past decade.

4. This history of the wheat programmes is documented in the sequence of reports by Narvaek, 1967, 1970; Anderson and Saari, 1978, 1974, 1975 and Anderson, 1976; and Razzaque, 1977.

TABLE 1 - WHEAT PRODUCTION IN BANGLADESH

| Years | Area (000 acres) | Production (000 tons) | Yield (md/ac) |
|-------------------|-----------------------|----------------------------|------------------|
| 1947/48 - 51/52 a | 93 | 21 | 6.1 |
| 1952/53 - 56/57 a | 105 | 24 | 6.3 |
| 1957/58 - 61/62 a | 126 | 30 | 6.4 |
| 1962/63 - 66/67 a | 154 | 41 | 7.4 |
| 1967/68 | 192 | 58 | 8.2 |
| 1968/69 | 290 | 92 | 8.6 |
| 1969/70 | 296 | 103 | 9.5 |
| 1970/71 | 311 | 110 | 9.6 |
| 1971/72 | 314 | 113 | 9.8 |
| 1972/73 | 297 | 90 | 8.2 |
| 1973/74 | 305 | 109 | 9.7 |
| 1974/75 | 311 | 115 | 10.0 |
| 1975/76 | 371 | 215 | 15.7 |
| 1976/77 | 395 | 255 | 17.6 |
| 1977/78 (P) | (450) | (351) | (21.2) |

Source : See Appendix Table A. 1

Notes a. Five year mean (average)

(P) Pre-harvest estimate : BADC Press Release (reported Bangladesh Times February 9th, 1978).

TABLE 2 ANNUAL RATES OF CHANGE IN ACREAGE, YIELD AND PRODUCTION OF WHEAT IN BANGLADESH^a

| Period | Area | Yield | Production |
|------------------------|--|-------|------------|
| | i. annual percentage rate of change | | |
| 1. 1947/48 to 1966/67. | | | |
| All varieties | + 3.4 | + 1.2 | + 4.5 |
| 2. 1967/68 to 1976/77 | | | |
| "Local" varieties | - 6.4 | - 1.1 | - 7.6 |
| "HYV" varieties | + 40.3 | + 2.3 | + 42.4 |
| All varieties | + 5.1 | + 6.6 | + 11.7 |
| | ii. percentage of rate of change in production | | |
| 1. 1947/48 to 1966/67 | | | |
| All varieties | 72 | 28 | 100 |
| 2. 1967/68 to 1976/77 | | | |
| "Local" varieties | 85 | 15 | 100 |
| "HYV" varieties | 95 | 5 | 100 |
| All varieties | 44 | 56 | 100 |

Source : Data from Bureau of Statistics (formerly Bureau of Agricultural Statistics) Crop Production Statistics (annual).

Notes : a. Exponential rates of change are estimated by least squares regression.

TABLE 3 AREA SOWN TO "LOCAL" AND "HYV" WHEAT AND DISTRIBUTION OF SEED BY BADC

| Year | Wheat Area | | | HYV as % Total | Annual change in HYV Area (000 ac) | BADC Seed (000 md) | Distribution ^e (6) as % (5) ^d |
|----------|----------------|--------------|----------------|----------------|------------------------------------|--------------------|---|
| | Local (000 ac) | HYV (000 ac) | Total (000 ac) | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1967/68 | 189 | 3 | 192 | 2 | — | 11.3 | — |
| 1968/69 | 269 | 12 | 290 | 7 | 18 | 27.8 | 154 |
| 1969/70 | 247 | 23 | 269 | 8 | 2 | 14.0 | 1390 |
| 1970/71 | 278 | 33 | 311 | 11 | 10 | 27.4 | 270 |
| 1971/72 | 278 | 37 | 314 | 12 | 4 | 19.4 | 485 |
| 1972/73 | 243 | 53 | 297 | 18 | 16 | 28.0 | 175 |
| 1973/74 | 233 | 72 | 305 | 24 | 19 | 36.1 | 189 |
| 1974/75 | 230 | 82 | 311 | 26 | 10 | 20.0 | 200 |
| 1975/76 | 153 | 218 | 371 | 59 | 136 | 132.5 | 97 |
| (a) | (86) | (266) | (352) | (76) | | | |
| 1976/77 | 107 | 288 | 395 | 73 | 70 | 47.7 | 68 |
| 1977/78P | 50 | 400 | 450 | 89 | 112 | 93.0 | 83 |

Source : See Appendix Table A. 1

a HYV Task Force Estimate (BADC, 1977)

b Area (HYV) in year (t) minus area (HYV) in year (t-1)

c Before 1971 BADC Seed distribution includes improved as well as dwarf (HYV) Seed

d Assumes seed rate of 1 maund per acre.

TABLE 4 WHEAT AREA, GOVERNMENT AND OTHER SOURCES OF SEED SUPPLY AND PRODUCTION IN BANGLADESH 1967/68 - 1977/78

| Years (t) | Wheat Area (000 ac) | BADC Seed Distribution (000 md) % of (1) ^b | | Other Sources of seed supply (000 md) % of (1) ^b | | BADC Seed Production (t-1) ^c (000 md) % of (1) | |
|--------------|------------------------|--|-----|--|-----|--|-----|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1967/68 | 192 | 12 | 6 | 180 | 94 | 3 | 2 |
| 1968/69 | 290 | 28 | 10 | 262 | 90 | 6 | 2 |
| 1969/70 | 296 | 14 | 5 | 282 | 95 | 10 | 3 |
| 1970/71 | 311 | 27 | 9 | 284 | 91 | 8 | 3 |
| 1971/72 | 314 | 19 | 6 | 295 | 94 | 10 | 3 |
| 1972/73 | 297 | 28 | 9 | 269 | 91 | 4 | 1 |
| 1973/74 | 305 | 36 | 12 | 269 | 88 | 12 | 4 |
| 1974/75 | 311 | 20 | 6 | 291 | 94 | 12 | 4 |
| 1975/76 | 371 | 133 | 36 | 238 | 64 | 19 | 5 |
| 1976/77 | 395 | 48 | 12 | 347 | 88 | 23 | 6 |
| 1977/78 | 450 | 93 | 21 | 357 | 79 | 30 | 7 |

(P)

Annual Rate
of change^a

| | | | | | | | |
|-----------|------|-------|---|------|---|-------|---|
| 1967/68- | | | | | | | |
| 1976/77 | +5.1 | +16.2 | — | +3.1 | — | +18.0 | — |
| 1967/68 - | | | | | | | |
| 1977/78 | +5.6 | +17.4 | — | +3.6 | — | +18.0 | — |

Source : Appendix Table A. 1

Notes : a. Rate of change estimated by ordinary least squares regression.

b. Assumes 1 maund per acre, therefore other source of supply (md) equals Wheat Area (acres) minus BADC Seed Distribution (md).

c. Seed produced in year (t-1) is available for next wheat season in year (t).

TABLE 5 SOURCES OF SUPPLY OF BADC WHEAT SEED

| Year | S. M. F. | Registered growers | Imports | Total (Supply) |
|---------------------------------------|-------------|--------------------|--------------|----------------|
| thousand maunds (% of total supply) | | | | |
| 1973/74 | 8.1 (21) | 6.0 (15) | 25.4 (64) | 39.5 (100) |
| 1974/75 | 8.5 (22) | 15.6 (41) | 14.1 (37) | 38.3 (100) |
| 1975/76 | 17.5 (12) | 18.3 (13) | 108.1 (75) | 144.0 (100) |
| 1976/77 | 19.1 (36) | 10.0 (19) | 24.5 (46) | 53.7 (100) |
| 1977/78 | 33.8 (32) | 9.8 (9) | 61.3 (58) | 104.8 (100) |

Source : BADC, unpublished data.

Note : S. M. F. - Seed multiplication farm.

TABLE 6 COMPARISON OF WHEAT YIELDS FROM OFFICIAL STATISTICS WITH MICRO STUDY DATA IN BANGLADESH

| | Irrigated HYV | Rainfed HYV | Rainfed Local |
|--------|-----------------|-------------|---------------|
| | (maunds/acre) | | |
| A C Pa | 23 | 15 | 8.0 |
| 74/75b | 15.5 | | 8.1 |
| 74/75c | 21.0 | --- | 8.3 |
| 75/76b | 21.2 | | 8.0 |
| 75/76d | 18-24 | 8-12 | |
| 75/76e | 17.3 | 10.8 | 7.2 |
| 75/76f | 17-40 | 10-22 | 5.15 |

Sources : a. Accelerated Cereals Production Program Projection (see Biggs and Clay, Table A2),

b. Bureau of Statistics average yields for Bangladesh.

c. Tangail ; Islam and Hussain, 1975

d. Brahmanbaria : N. Ahmed, 1976.

e. Jamalpur, Jessore ; own unpublished data for 140 wheat cultivators.

f. Report of HYV Task Force, 1975/76 (BADC, 1977).

REFERENCES

- M. Ahmed, 1977 Muslehuddin Ahmed. "Ten years review of extension and production of rice and wheat." In BRRI, 1977, pp. 84-97.
- N. Ahmed, 1976 N. U. Ahmed, "Cost of production of Boro paddy and wheat cultivation per acre." Dacca : USAID, 1976.
- R. Ahmed, 1976 R. Ahmed, "Foodgrain production in Bangladesh : an analysis of growth, its sources and related policies." Washington : International Food Policy Research Institute, 1976 (Reprinted as BARC Agricultural Economics and Rural Social Science Studies No. 2, Dacca : BARC, 1977).
- Anderson and Saari, 1973 R. G. Anderson & E. E. Saari, "Wheat research and production in Bangladesh." Dacca : Ford Foundation, 1973.
- Anderson and Saari, 1974 R. G. Anderson & E. E. Saari, "Wheat research and production in Bangladesh, II." Dacca : Ford Foundation, 1974.
- Anderson and Saari, 1975 R. G. Anderson & E. E. Saari. "Wheat research and production in Bangladesh. III (Bangladesh—A New Wheat Country)." Dacca : Ford Foundation, 1975.
- Anderson, 1976 R. G. Anderson, "Wheat research and production in Bangladesh IV (an assessment of Bangladesh's wheat production campaign 1975/76' '(Report No. 41) Dacca : Ford Foundation, 1976.
- BADC, 1977 Bangladesh Agricultural Development Corporation, "HYV Task Force Reports 1974/75 and 1975/76." Dacca : 1977.
- Bangladesh, Government of Bangladesh "The first five year plan, 1973-78" Dacca : 1973.
- BRRI, 1977 Bangladesh Rice Research Institute, "Workshop on ten years of modern rice and wheat cultivation in Bangladesh : March 7-10, 1977." Dacca : 1977.
- Biggs and Clay, 1975 S. D. Biggs & E. J. Clay, "Wheat in Bangladesh : an economic analysis of past, present and future developments." Dacca : Ford Foundation, 1975.
- Hashem, 1977 A. Hashem, "Experience on modern rice cultivation and seed distribution trends in BADC S. M. Farms" in BRRI, 1977, pp. 219-235.
- Islam and Hossain, 1975 M. S. Islam & M. K. Hossain, "An economic study of local and high yielding varieties of wheat production in some selected areas of Tangail District." Mymensingh : Bangladesh Agricultural University, Dept. of Agricultural Economics 1975.
- Malck, 1977 M. A. Malek. "Ten years review and current status of input supply for rice and wheat." in BRRI, 1977,
- Narvaez, 1967 I. Narvaez M., "Wheat breeding and production in East Pakistan, observation and proposals." Dacca : 1967 (unpublished).

- Narvaez, 1970** I. Narvaez M., *Wheat breeding and production in East Pakistan, observations and proposals.* Dacca : Ford Foundation, 1970.
- H. Rahman, 1977** A. F. M. Hafizur Rahman, "Result of fertilizer trials of rice and wheat in farmers' fields." in BRRI, 1977, pp. 119-135.
- Razzaque, 1977** A. Razzaque, "Review of ten years on modern wheat research in Bangladesh." in BRRI, 1977.
- World Bank, 1973** World Bank, "*Bangladesh : appraisal of the cereal seeds project.*" (144a-BD) Washington : 1973.

TABLE A. 1 WHEAT STATISTICS FOR BANGLADESH SINCE 1966/67

| Year | Local | | HYV | | Total | | BADC Seed Production | BADC Seed Distribution | Area Irrigated |
|------------|-------|--------------|------|--------------|-------|--------------|----------------------|------------------------|----------------|
| | Area | Yield Output | Area | Yield Output | Area | Yield Output | | | |
| 1966/67a | 180 | 8.2 | 58 | 0 | 0 | 58 | 3,325 | 12,299 | na |
| 1967/68b | 189 | 8.2 | 58 | 3 | 18.0 | 2 | 6,063 | 11,344 | na |
| 1968/69c | 269 | 8.1 | 80 | 21 | 16.1 | 12 | 9,633 | 27,780 | na |
| 1969/70c | 274 | 8.9 | 90 | 23 | 16.3 | 13 | 8,298 | 14,033 | 22 |
| 1970/71c | 278 | 8.9 | 91 | 33 | 15.5 | 19 | 9,789 | 27,400 | 28 |
| 1971/72c | 278 | 9.1 | 93 | 37 | 15.2 | 20 | 4,340 | 19,417 | 23 |
| 1972/73c | 243 | 7.3 | 66 | 53 | 12.2 | 24 | 11,619 | 27,982 | 34 |
| 1973/74c | 233 | 8.0 | 68 | 72 | 15.4 | 41 | 12,103 | 36,072 | 34 |
| 1974/75c | 230 | 8.1 | 68 | 82 | 15.5 | 47 | 19,302 | 19,950 | 45 |
| 1975/76c | 153 | 8.0 | 45 | 218 | 21.2 | 170 | 23,208 | 132,511 | 125 |
| 1976/77c | 107 | 7.6 | 30 | 288 | 23.3 | 226 | 32,521 | 47,749 | na |
| 1977/78(p) | 50d | 8.0g | 1.5g | 400d | 2.5g | 336g | na | 93,006d | na |
| | | | | | | 450d | | | |
| | | | | | | 21.2d | | | |
| | | | | | | 351d | | | |

Source : a Bangladesh Bureau of Statistics : "Agricultural production levels in Bangladesh (1947 - 1972)" ; Dacca : 1976.

b Moslehuddin Ahmed (1978) in BERRI (1978). Figures in Brackets are from (a)

c Bangladesh Bureau of Statistics : Crop production Statistics (annually)

b BADC Press Release reported in Bangladesh Times, 9 February 1978.

e BADC, "Basic Statistics," Dacca : 1977 (maunds)

f Bangladesh Bureau of Statistics : "Statistical Pocket Book of Bangladesh 1978" Dacca : 1977 (000 ac). Own estimates based on (b) assuming average yield "local varieties" as 8.0 md/ac

Area--000 acres ; yield -- maunds/acre ; output -- 000 long tons.

TABLE A. 2 INDEX OF BANGLADESH WHEAT ACREAGE, YIELDS AND PRODUCTION 1967/68-1977/78. (1969/70)=100.

| YEAR | AREA | | | YIELDS | | | PRODUCTION | | |
|------------|-------|--------|-------|--------|-----|-------|------------|------|-------|
| | Local | HYV | Total | Local | HYV | Total | Local | HYV | Total |
| 1967/68 | 69 | 13 | 65 | 92 | 110 | 89 | 64 | 15 | 58 |
| 1968/69 | 98 | 91 | 98 | 91 | 99 | 91 | 89 | 92 | 89 |
| 1969/70 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1970/71 | 101 | 143 | 105 | 95 | 101 | 101 | 146 | 146 | 107 |
| 1971/72 | 101 | 161 | 106 | 102 | 93 | 103 | 103 | 154 | 110 |
| 1972/73 | 89 | 230 | 100 | 82 | 74 | 86 | 73 | 185 | 87 |
| 1273/74 | 85 | 313 | 103 | 90 | 94 | 102 | 76 | 315 | 106 |
| 1974/75 | 84 | 357 | 105 | 91 | 95 | 105 | 76 | 362 | 112 |
| 1975/76 | 56 | 948 | 125 | 90 | 130 | 165 | 50 | 1308 | 209 |
| 1976/77 | 39 | 1252 | 133 | 85 | 143 | 185 | 33 | 1734 | 248 |
| 1977/78(p) | (18) | (1739) | (152) | na | na | (223) | na | na | (341) |

Source : Bangladesh Bureau of Statistics, Crop Production Statistics (annual)

(P) Provisional estimate, BADC Press Release, Bangladesh Times, 9 Feb. 1978.