Integrated crop management of chickpea in environments of Bangladesh prone to Botrytis Grey Mould

C Johansen[1, 8], MA Bakr[2], M Sirajul Islam[3], MA Mondal[4], A Afzal[5], W.J. MacLeod[6, 8], S Pande[7] and Kadambot H.M. Siddique[8]

[1] 15 Westgate Court, Leeming, WA 6149 Email cjo41802@bigpond.net.au
[2] Pathology Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh
[3] On-Farm Research Division (OFRD), BARI, Faridpur, Bangladesh
[4] OFRD, BARI Regional Agricultural Research Station, Jessore, Bangladesh
[5] Pulses Research Centre, BARI, Joydebpur, Gazipur, Bangladesh
[6] Department of Agriculture and Food WA, Northam, WA
[7] International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh 502 324 India
[8] Faculty of Natural & Agricultural Sciences, Centre for Legumes in Mediterranean Agriculture (CLIMA), The University of Western Australia, Crawley, WA 6009

Abstract

Botrytis grey mould (BGM) is the major constraint to chickpea in Bangladesh and is considered primarily responsible for recent drastic decreases in chickpea production there. As there is no substantial varietal resistance to BGM in chickpea agronomic options to manage the disease were evaluated in farmers' fields to hasten transfer of this technology to Bangladeshi farmers. Effective measures against BGM were combined with otherwise optimum region-specific agronomy for chickpea into an integrated crop management (ICM) package. BGM management options included use of a chickpea variety less susceptible to BGM, lower seed rate, plant thinning and delayed sowing to ensure an open canopy, and need-based foliar application of fungicide. On-farm evaluations (OFE) of the ICM package compared with normal farmer practice (FP) for chickpea cultivation were established in farmer-managed, operational scale plots at 100 locations across five districts in the 2002-03 and 2003-04 seasons. Grain yields in ICM plots were generally 15-50% higher than in FP in both seasons. In 2004-05, 480 farmer-managed demonstrations were conducted in these 5 districts, giving a 5-42% yield advantage of ICM over FP. Expansion of the program into three more districts in 2004-05 gave similar results. Effective implementation of BGM management practices by farmers demonstrated that profitable chickpea yields could be reliably obtained in this BGM-prone environment.

Key Words

BGM, on-farm evaluation, integrated crop management, crop canopy, foliar fungicide

Introduction

Botrytis grey mould (BGM), caused by *Botrytis cinerea* Pers. ex. Fr., is a major yield reducer of chickpea (*Cicer arietinum* L.) in Bangladesh, Nepal and eastern India (Bakr et al. 2002). The reduction in chickpea area sown in Bangladesh from >100,000 ha in the 1980s to around 15,000 ha in 2001 is primarily attributed to the yield instability caused by BGM. Nevertheless, chickpea remains an important staple food of Bangladesh and ever-increasing imports of the grain are required to meet demand. Only minimal levels of varietal resistance to BGM have been found but research station trials in small plots have shown that the disease can be managed through maintaining an open crop canopy and judicious application of foliar fungicides. These management options were combined into an integrated crop management (ICM) package and successfully evaluated in operational scale plots in farmers' fields in Nepal, from 1998 (Pande et al. 2003). Under an ACIAR funded Project (No. CIM/2001/039), this procedure was extended to the traditional chickpea growing areas of Bangladesh from 2002 in an attempt to accelerate transfer of recently evolved knowledge on chickpea production technology, particularly in relation to disease management, to Bangladeshi farmers.

Methods

A participatory approach was followed which involved extension personnel and farmers in activities across the entire research-to-adoption spectrum. To test research station findings on components of disease management under farmers' conditions, on-farm trials (OFT) were conducted. OFTs conducted during 2002-03 to 2004-05 examined effects of seed priming, fungicidal seed treatment, mixed cropping and farmers' varietal preferences. Promising components were assembled into ICM packages and evaluated in operational scale plots under farmer management in on-farm evaluations (OFE). When OFEs confirmed the superiority of ICM over the local chickpea cultivation practice then on-farm demonstrations (OFD) were done.

From the 2002-03 season, OFEs compared the best-bet ICM package with prevailing farmers' practice (FP) in paired plots of 666 m^2. There were 100 such comparisons across 5 districts in each of 2002-03 and 2003-04, and a further 30 in 3 new districts in 2004-05. After receiving training and inputs for chickpea cultivation that they do not normally use, farmers implemented OFEs, with monitoring from project and extension (Department of Agricultural Extension) personnel. For BGM management the currently recommended ICM practice is use of a chickpea variety less susceptible to BGM (mainly BARI chola 5), reduced seed rate, delayed sowing and thinning to prevent excessive vegetative growth, and need-based foliar application of fungicide (usually Bavisitin[?]). Other important components of the ICM package are application of superphosphate (20 kg P/ha), seed treatment with Vitavax-200[?] to minimize collar rot (*Sclerotium rolfsii*) and integrated management of *Helicoverpa armigera* (scouting for eggs and young larvae, placing of perches to encourage predator birds and need-based insecticide spray). In FP plots these measures were not taken. Plots that grew poorly for extraneous reasons (e.g. animal grazing damage) were excluded from the analysis. In 2004-05, there were 480 demonstrations of ICM in 1,333 m^2 plots in the original 5 districts. Like OFEs, OFDs and were conducted in clusters of 5, around a village, and for OFDs one farmer's plot near a cluster was harvested to serve as a FP control. There were 20 OFD clusters in all five original districts, except Faridpur where there were 18.

Results

There was frequent rainfall during the 2002-03 growing season causing severe BGM infestation. The subsequent growing seasons were essentially dry but BGM still reduced flower/pod set in FP treatments. Yields were generally lower in 2002-03 than later seasons but ICM significantly improved yields (Table 1). Yield improvement with ICM across seasons was of the order of 15-50 %, and similar levels of response were observed in OFDs (Table 1).

Table 1. District means of chickpea grain yield (t/ha) in integrated crop management (ICM) and farmer practice (FP) treatments in on-farm evaluations (OFE) and demonstrations (OFD) in BGM-prone districts of Bangladesh.

District	2002-03			2003-04			2004-05[1]		
	FP	ICM	*% increase*[2]	FP	ICM	*% increase*	FP	ICM	*% increase*
Jessore	**0.34**	0.48	*41***(19)*	0.84	1.12	*33***(15)*	0.97	1.15	25*
Magura	**0.42**	0.52	*24***(15)*	1.04	1.22	*17***(18)*	1.01	1.25	32***
Jhenaidah	0.82	0.92	*12**(10)*	1.11	1.41	*27***(18)*	1.02	1.20	42***

Faridpur	**0.41**	0.49	*21***(20)*	0.67	1.03	*49*(15)*	0.93	1.19	19[ns]
Rajbari	**0.16**	0.28	*77***(20)*	0.71	0.94	*31****	1.01	1.06	5 [ns]
Chuadanga	-	-	-	-	-	-	1.00	1.37	*37***(10)*
Kushtia	-	-	-	-	-	-	0.62	0.90	*46***(10)*
Pabna	-	-	-	-	-	-	0.61	0.83	*36***(10)*

[1] In 2004-05, OFDs in 5 original districts and OFEs in Chuadanga, Kushtia and Pabna; all OFEs in 2002-03 and 2003-04.
[2] Significance of difference between FP and ICM: ns = not significant, * = P<0.05, ** = P< 0.01, *** = P<0.001. Numbers of comparisons in OFEs in parentheses.

Conclusions

Farmers were able to implement ICM packages to obtain substantial yield advantages under upper and lower extremes of BGM infestation. Yield levels exceeding 1 t/ha, as generally obtained in 2003-04 and 2004-05, made chickpea competitive with other cropping options, including irrigated crops. Rehabilitation of chickpea as a rainfed winter season crop through the adoption of the above technologies in Bangladesh is anticipated

References

Bakr MA, Siddique KHM and Johansen C (eds) (2002). Integrated management of botrytis grey mould of chickpea in Bangladesh and Australia: summary proceedings of a Project Inception Workshop, 1-2 June 2002, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh. Joydebpur, Gazipur, Bangladesh: BARI; and Crawley, WA 6009, Australia: CLIMA. 138 pp.

Pande S, Bourai, VA and Neupane RK (2003). Wealth generation through chickpea revolution. IPM of chickpea in Nepal-3. Information Bulletin No. 66. Patancheru, AP 502 324, India: ICRISAT. 36 pp.