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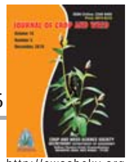

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Estimates of wheat improvement in the Central Zone by REML/BLUP procedure

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ABSTRACT

Highly significant change in wheat production for irrigated timely sown, late sown and restricted irrigated timely sown trials had been observed during 2008-09 to 2017-18 in the Central Zone of India under multi environment trials. BLUP's of genotypes yield were predicted by efficient factor analytic approach. Production elevated to the level of 52, 48 and 39q ha^{-1} for irrigated timely, late and restricted irrigated timely sown conditions, respectively. Base yield levels in year 2008-09 were 4901, 4112 and 2405 kg ha^{-1}. Significant straight line equations depicted the 0.48, 0.65 and 1.77q yield added trials over the years.

Keywords: G×E interaction, best linear unbiased predictor and residual maximum likelihood

G × E interaction must be considered in wheat breeding programs as significant effects of interaction observed in recent studies (Braun *et al.,* 2010; Crespo *et al.,* 2017; Mohamed, 2013). Large number of studies attempted to characterize genotypes performance in response to varying environments (Yeater *et al*., 2014). AMMI analysis is considered as a powerful multivariate methodfor multi-environmental trials (Gustavo *et al.*, 2016). This procedure has showed an increase in estimation accuracy by separating the pattern from the noise in the residuals of the additive model. Moreover, main and interaction effects were considered as the fixed ones (Piepho *et al*, 2008). This feature may not be suitable in analyzing multi environment trials conducted at research centers across the country (Hu, 2015). Prediction of random variables is commonly done by Best Linear Unbiased Prediction (BLUP) (de Pelegrin *et al.,* 2017).Mixed model framework allows estimation of genotypes as fixed and prediction of environments and genotypes × environment interactions as random (Mendes *et al.*, 2014). BLUP maximizes the correlation between genotypic and predicted genotypic values (Piepho and Eckl, 2014). Recent and efficient modeling technique for G × E interaction is the factor analytical (FA) with heterogeneity of variances that uses the leading principal components of the variance-covariance G×E matrix yielding a more parsimonious variance-covariance structure (Burgueño *et al*, 2008; Smith *et al.*, 2015).

MATERIALS AND METHODS

Central Zone of India comprises Madhya Pradesh, Chhattisgarh, Gujarat, Rajasthan (Kota and Udaipur divisions) and Jhansi division of Uttar Pradesh. This zone is known for premium quality wheat having typically hard lustrous grains with high gluten strength. The advanced varietal trials under irrigated timely sown, late sown, restricted irrigated trials were conducted during the period 2008-09 to 2017-18 at the major locations of this zone. Details of genotypes and locations as per year wise were reflected in tables 4, 5 & 6 for completeness. Estimation of the variance parameters carried out by using residual maximum likelihood (REML) along with estimation or prediction of the fixed as well as random effects. Quite popular and widely cited ASReml-R package exploited to fit models which uses the average information algorithm for REML estimation of variance parameters. The implementation for FA models in ASReml-R package handles the situations of where rank of interaction matrix is of less than full rank. Regression analysis was carried out by SAS software version 9.3.

Under MET g genotypes are evaluated in e environments and analyzed as per model

$$y_{ijk} = \mu + \tau_i + \delta_j + (\tau\delta)_{ij} + \gamma(\delta)_{jk} + \varepsilon_{ijk}$$

yijk yield of k replication of ith genotype in j environment	μ overall mean	τ_i Effect of genotype	δ_j Effect of environment	$(\tau\delta)_{ij}$ Interaction effect	$\gamma(\delta)_{jk}$ Effect of k-th replication in j-th environment	ε_{ijk} Random error

i= 1,2,3,…g; j=1,2,3,…e; k=1,2,3,…r

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RESULTS AND DISCUSSION

Highly significant change in wheat production had been observed during the last ten years span for irrigated timely sown, late sown and restricted irrigated timely sown trials in the Central Zone of country as reflected in ANOVA tables (1, 2 and 3). Significance of intercept and slope of linear model had been reflected in tables for three conditions.

Year wise BLUP's of wheat production was plotted against the years to examine the coefficient of determination (R^2) and linear trend for assessing progress in wheat production for irrigated timely, irrigated late & restricted irrigated timely sown conditions. Regression analysiswas applied to same data to test significance level of the R^2 value which was same as recorded in the linear trend line. Regression analysis for production revealed that under restricted irrigated timely-sown condition, the R^2 value was highly significant ($P<0.01$) and significant for irrigated late sown trials (Table 3).Under the late-sown conditions, area under cultivations had decreased in zone so trials were discontinued for further years though yield improvement was highly significant. Significant improvement was also visible in restricted timely-sown conditions of the zone.

Linear trend in the year-wise wheat production indifferent conditions revealed an increase in average production of promising genotypes in zone and by the end of 2018. The production figures elevated to the level of 52q ha^{-1} (Fig. 2) in irrigated timely sown, of 48q ha^{-1} (Fig. 4) under irrigated late sown and of 39q ha^{-1} (Fig. 6) for restricted irrigation under timely sown. However, in 2008-09, average production was 46, 41 and 20q ha^{-1} respectively and by the end of 2018, 0.48, 0.65 and 1.77q yield, respectively could be added in subsequent trials. Although, higher yields of 56 q ha^{-1} (2013-14), 48 q ha^{-1} (2012-13) and 41 q ha^{-1} (2016-17) were obtained in irrigated timely, late and restricted irrigation trials, respectively. Moreover low value of R^2 value justified highly variable nature of production. Fitted straight-line equations by SAS software displayed in corresponding figures indicate that the linear growth was observed under irrigated timely and late sown as well as restricted irrigated timely sown conditions. During the year 2008-09, the base yield levels were 4901, 112 and 2405 kg ha^{-1} (intercept of the equation). The straight line equations depicted the linear trends in yield growth over years and the equation also fitted well (maximum R^2=0.6649*** for restricted irrigation timely sown) with the yield data. More over yield increase in the zone progressed in linear fashion with annual increment of 47.83, 65.05 and 176.76 kg ha^{-1} $year^{-1}$ in irrigated timely, late and restricted irrigated timely sown.

Table 1: ANOVA for irrigated timely sown conditions

Source	Sum ofSquares	MeanSquare	F Value	Pr > F	R-Square	Root MSE	CV	StandError	t Value	Pr > |t|
Model	78.78223	78.78223	13.28	0.0007	0.2359	2.43577	4.73322			
Error	255.11761	5.93297								
Total	333.89984									
Parameter	Estimates									
Intercept								0.76277	64.26	<.0001
Year								0.13124	3.64	0.0007

Table 2: ANOVA for irrigated late sown conditions

Source	Sum ofSquares	MeanSquare	F Value	Pr > F	R-Square	Root MSE	CV	StandError	t Value	Pr > |t|
Model	59.24885	59.24885	9.10	0.0049	0.2162	2.55143	5.83520			
Error	214.82367	6.50981								
Total	274.07252									
Parameter	Estimates									
Intercept								0.96435	42.64	<.0001
Year								0.21564	3.02	0.0049

Table 3: ANOVA for restricted irrigated timely sown conditions

Source	Sum ofSquares	MeanSquare	F Value	Pr > F	R-Square	Root MSE	CV	StandError	t Value	Pr > |t|
Model	1124.75865	1124.75865	75.41	<.0001	0.6649	3.86196	11.74239			
Error	566.75984	14.91473								
Total	1691.51849									
Parameter	Estimates									
Intercept								1.18685	20.26	<.0001
Year								0.20354	8.68	<.0001

Comparatively large value of CV confirmed more production had achieved under restricted irrigation conditions as CV varies from 4.7, 5.8 to 11.7.

Under restricted irrigated timely sown conditions of the zone, highly significant yield increase over years was registered and the linear trend was noticed from the base yield with annual increment of 1.76 q ha^{-1} along with highest growth rate per year. Study revealed that last 10 years of wheat production in the zone had witnessed remarkable progress in situations of hue and cry for climate change and hot and dry conditions, wheat yield has improved in three production conditions.

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Guidance of Dr J Crossa, Dr M Vargas and financial support extended by Dr AK Joshi & Dr RP Singh, CIMMYT are being sincerely acknowledged by the authors. Efforts of staff, working at various centers, are highly appreciated for field evaluation under coordinated system of wheat.

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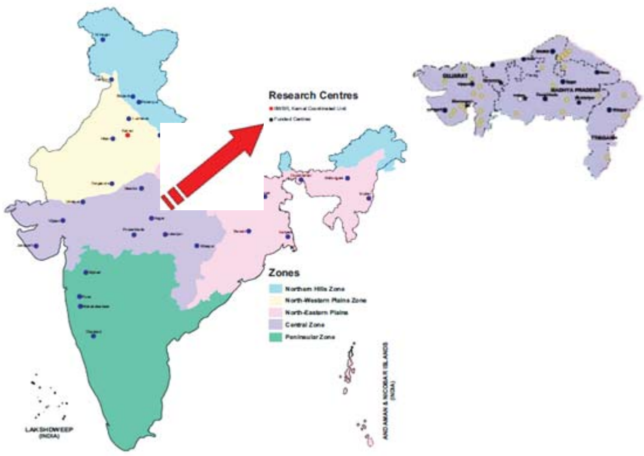

Fig. 1: Agro climatic zones of country for wheat coordinated trials

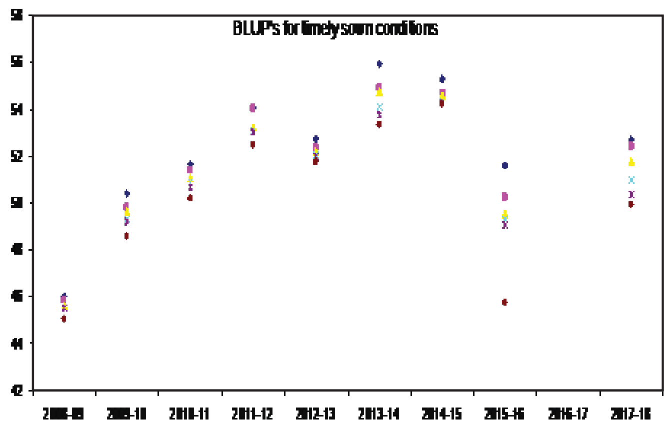

Fig. 2: Best linear unbiased predictors of promising genotypes for irrigated timely sown condition

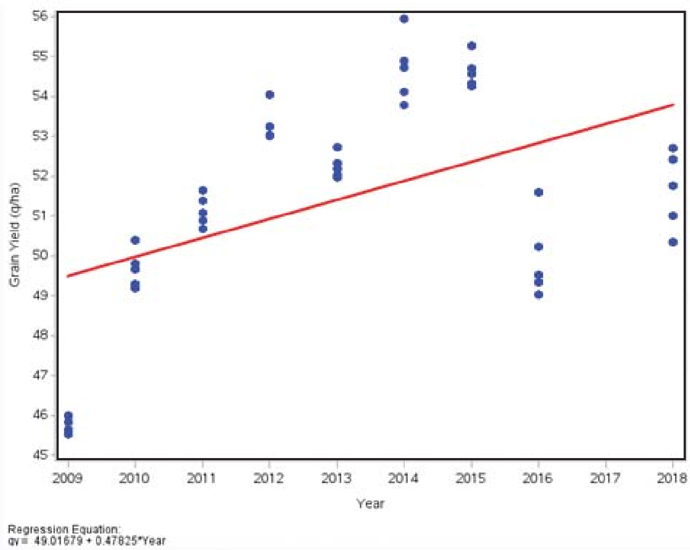

Fig. 3: Regression analysis of BLUP's of promising genotypes for irrigated timely sown conditions

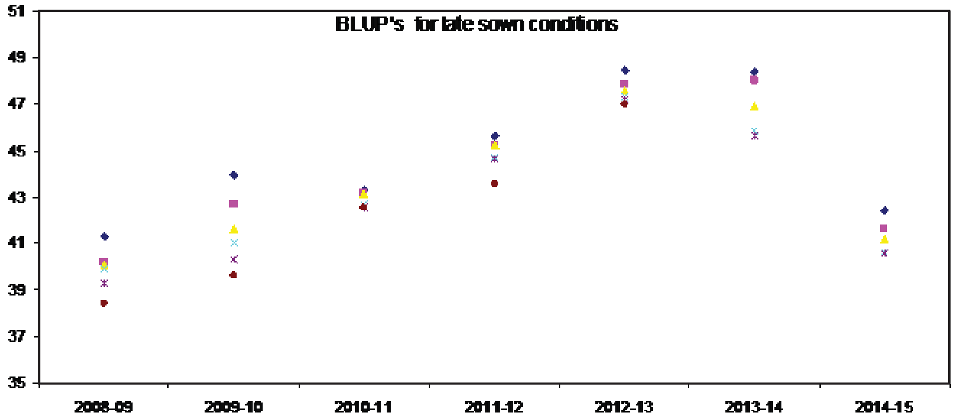

Fig. 4: Best linear unbiased predictors of promising genotypes for irrigated late sown condition

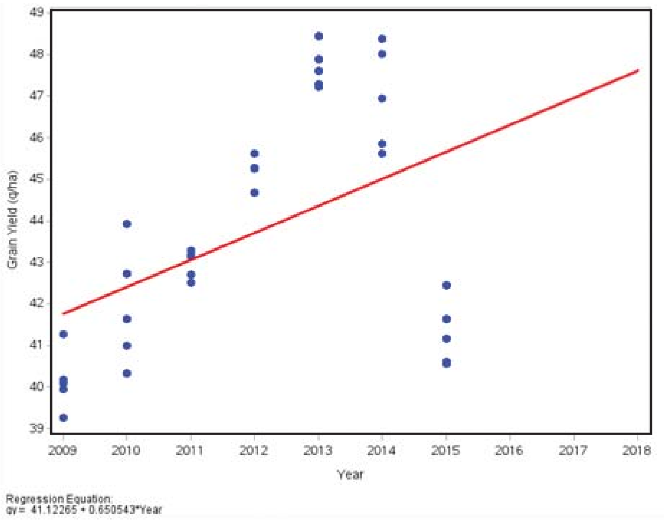

Fig. 5: Regression analysis of BLUP's of promising genotypes for irrigated late sown conditions

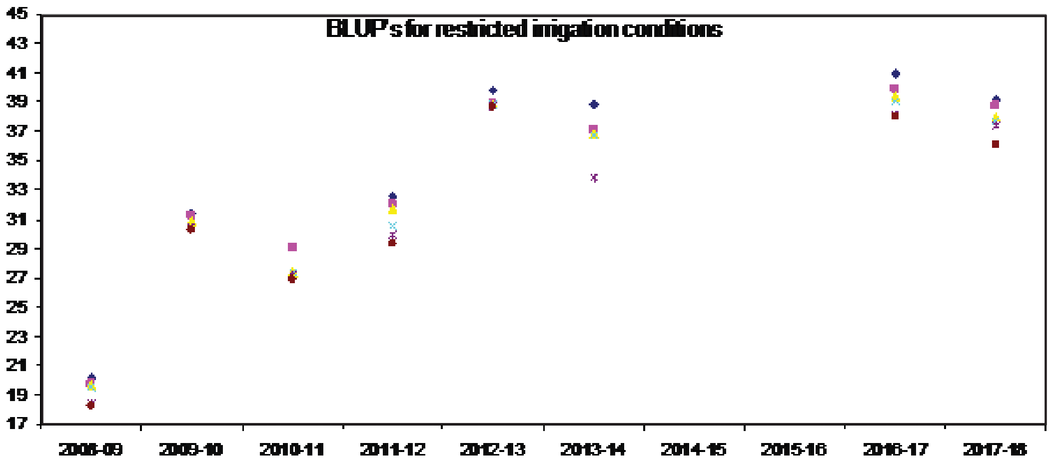

Fig. 6: Best linear unbiased predictors of promising genotypes for timely sown restricted irrigations condition

Table 4: Genotypes along with parentage details for irrigated timely sown trials

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2017-18
MPO1215@*(GW1113/GW1114//HI8381)	HW5207-1* (HW3029/YR15)	HI8704(D)* (HD 4502/HI 8498//HI 8498)	HI 8728(D) (CD 91195/HI 8381//CPAN 6225/HI 8335)	HI8724(D)* (HI 8416/SL//HI 8498//HD 4708)	HI8737*(D)(HI8177/HI8158//HI 8498)	HD4730(D)*(ALTAR84/STINT//SILVER45)	HI8759(D)* (HI8663/HI8498)	GW1339(D) (DDW04/4/MEMO/YAV//AVK/3/RD214)
HD4719@*(PDW233/RD428(PBW34/EGYPTIAN DURUM//HD 4502/T.TURGIDUM)	HI8691(D)* (HG509/HI8381)/(BOOMER-33/PLATA8)	GW418(GW 314//HW 921/PBW 138/3/HI 1183/J/170)	HI8713*(D)(HD 4672/PBW 233)	HI8735(D)(HI 8511/RD429//HD 4672)/HD 4672)	HD4730(D)(ALTAR84/STINT//SILVER45)	HD4728(D)*(ALTAR84/STINT//SILVER_45/3/SOMAT_3.1/4/GREEN_14// YAV_I0/AUK)	HI8774(D)(HI8663/HI8498)	AKAW4924(DL-9-65-2/AKW1071-1-2)
GW391* (JUP/ZP/COC/3/PVN/4/GEN/5/BOW//BUC/BUC/6/VEE#5//DOVE/BUC/7/GW273/8/GW273)	MACS3742(D)* (HI 8540/PDW216//HI8498)	JWS135 (K 9405/UP 2490)	HI 8726(D)(JAIRAJ/HD 4672//HI 8498)	GW440(GW 293/UP 2425)	GW451(GW 324/4/CROC- 1 /A. SQURROSA(205)//J U P/BJY/3/../5/GW339)	GW463(GW496/KLPO1 O)	PDW344(D)(GREEN/RXD-130)	GW495(LOK54/RAJ 4083)
HI1560 (SKAUZ*2/FCT)	AKDW4021(D)*(AJAIA-12/F3 LOCAL(SEL.ETHIO .135.85)	RAJ4235(RAJ 3777/HP 1731)	HI 8727(D)(HI 8591/HG 110//HI 8498)	HI8737(D)(HI 8177/HI8158//HI8498)	HI 8750(D)(HG822/HI8498)	HI8759(D)(HI8663/HI8498)	HI8498(D)©(RAJ6O7O/RAJ911)	UAS465(D)(STOT//ALTAR84/ALD*2/3/AUK/GUIL//GREEN)
HI8690@(HI8416/SARANGAPUR LOCAL)/HI 8498)	HI1567(HI1136/HW 3024)	MP1246(HY 11/HW 2010/NI 5439//CPAN 1220/PBW 168)	MACS 3828*(D)(ALTAR 84/STINT//SILVAR 44/3/SOMAT3.1/4)	HI8727(D)*(HI 8591/HG110//HI 8498)	MP 3382*(C H O I X/STAR/3/HE1 /3 *C N O 7 9// 2* SERI/ 4/ GW 27 3)	MPO1215(D)©(GW1113/GW1114//HI8381)	HI8737(D)©(HI8177 /HI8158//H I8498)	MPO1343(D)(HG822/HI8498)
HI8691@(HG 509/HI8381)/(BOOMER-33/PLATA8)	HI1568(355 MO88/MILAN/HW2045//WR329)	HI8713(D)(HD 4672/PBW 233)	GW 1277(D)(SRN 3/SULA//BUKEM2/3/DAKYAY2//SLA 2)	HI8736(D)(HI 8416/SARANGPUR LOCAL/HD 4672)	HI 8736*(D)(HI8416/SARANGPUR LOCAL/HD4672)	HI8498(D)©(RAJ6070/RAJ911)	MPO1215(D)©(GW1 1 3/GW1 1 1 4//HI8381)	GW322©(PBW173/GW196)
HI8693@(GUJI'S'/PDW251)/MACS3125)	MACS6274(CHIBA//PRLII/CM65531)	HI8715(D)(HG623/HD 4672)/HD 4672)	GW428Q(GW 293/NIAW 725)	HD3114(HW 2002/WR 196//SONALIKA/T.PONLONICUM//WR 196)	MACS 6604(WAXWI N G/4/S N I/TRAP#1 / 3 / KAUZ*2/T RAP // KAUZ)	HI1544©(HINDI62/BOBWHITE/CPAN2099)	HD4728(D)(I)© (A LTAR84/S T I N T//S I L V E R_4 5/ 3/SOM AT_3 . 1 /4 /GREEN_14//Y AV_10/AUK) GIREEN_1 4 INAV_10/AUK)	HI8713(D)©(HD4672/PDW233)
HW5207-1 (HW3029/YR15)	GW408(GW244/4/PRL/SARA//STAR/3/GALVEZ)	MACS3828(D)(ALTAR 84/STINT//SILVAR 44/3/SOMAT 3.1/4.)	HI 8725(D)(HI8498/PDW 233)	HI8725(D)*(HI 8498/PDW 233)	HD 4728(D)(ALTAR84/STINT//SILVER_ 45/3/SOMAT_ 3.1/4/GREEN_ 14//YAV _1O/AUK)	GW322©(PBW173/GW196)		HI8737(D)©(HI8177/HI8158//HI8498)
MACS3742@(HI8540/PDW216//HI8498)	GW411(HW2017/AKW2861-2//GW273)	WHD948(D)(ALTAR 84/STINT//SILVER)	MP 1259(GW 173/HW 888//HI 1077/GW 173)	DDW23(D)(DDW 01/HI 8498)	GW 322©(PBW173/GW196)	HI8737(D)(I)©(HI8177 /HI8158//H18498)		HI1544©(HINDI62/BOBWHITE/CPAN2099)
PDW315@(PDW252/PDW251)	NIAW1549(D)(KAUZ*2/CHEN//BCN/3/MILAN)	HI1544©(HINDI 62/BOB WHITE/CPAN 2099)	MPO 1262(D)(GUAYACANINIA/3/STOT//ALTAR 84/ALD/4/…)	MP3382(CHOIX/STAR/3/HE1/3* CNO 79//2*SERI/4/GW 273)	HI 1544©(H I N D I62/BOBWHITE/CPAN2O99)			
MP1226@(	AKAW4493(SKAUZ*/PRLII/CM655-31)	GW322©(PBW 173/GW 196)	PDW 327(D)(PDW 291/HI 8672R)	HI 1588Q(HD 2402/HW 3007)	HI 8498(D)©(RAJ6070/RAJ911)			
MP4080 (SKAUZ*2/FCT)	LOK62(SHARBATI SONORA/C 306/LOK1//HS 295)	LOK1©(S 308/ S 331)	GW 1276(D)(GW 1114/RD 306)	HI1544©(HIND162/BOB WHITE/CPAN 2099)	MPO 1215(D)©(GW1 1 13/GW1 114//HI8381)			

Cont....

Cont. Table 4

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2017-18
AKDW4021@(AJAIA-12/F3 LOCAL(SELETHI-135.85)	UAS321(BAV 92/PRINIA//TAM 200/PRL/UAS 251)	HI8498(D)©(RAJ 6070/RAJ 911)	HI 8724(D)(HI 8416/SL//HI 8498//HD 4708)	GW322©(PBW 173/GW 196)				
DDW14@(GULAB/DCB)	HI8703(D)(HD 4502/HI 8498//HI 8498)	MPO1215(D)©(GW 1113/GW 1114//HI 8381)	UPD 93(D)(HI 8498/SOMBRA 20)	HI8498(D)©(RAJ 6070/RAJ 911)				
DDW15@(IDSN80/RAJ 1555)	HI8704(D)(HG 822/HI 8498)		MACS 3817(D)(MACS 3125/LINE 68//LINE 68)	MPO1215(D)©(GW 1113/GW1114//HI8381)				
LOK1# (S 308/S 331)	MACS3744(D)(PD W272/PDW 215//HI 8498)		GW 322©(PBW 173/GW 196)	HI8713(D)(I)©(HD 4672/PBW 233)				
GW322# (PBW 173/GW 196)	MPO1215(D)(I)#(G W 1113/GW 1114//HI 8381)		HI 8498(D)©(RAJ 6070/RAJ 911)					
GW366# (DL 802-3/GW232)	LOK1#(S 308/S 331)		HI 1544©(HINDI62/BOB WHITE/CPAN 2099)					
HI1544#(HINDI 62/BOB WHITE/CPAN 2099)	GW322#(PBW 173/GW 196)		MPO 1215(D)©(GW 1113/GW 1114//HI8381)					
HI8498@#(RAJ 6070/RAJ 911)	HI1544#(HINDI 62/BOB WHITE/CPAN 2099) HI8498(D)#(RAJ 6070/RAJ 911)							

Table 5: Genotypes along with parentage details for irrigated late sown trials

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AKAW4627* (WH147/SUNSTAR*/C 80.1)	MP4106* (CHIBIA/PRL 11/CM 65531)	RAJ4238 (HW 2021/RAJ 3765)	MP 3336* (HD 2402/GW 173)	RAJ 4295 (RAJ 3765/NW 2006)	GW455 (J429/DL790-1//PBW510)	CG1015 (NI908/BL1986)
GW406 (WL 433)	MP1237 (DL 784-3/MP 945/HW 2022//IBWSN 166/GW 273)	MP3304* (GW 322/J 485)	DBW90 (HUW468/WH 730)	HD3095* (CPAN 3004/WR 426//HW 2007//HD 2851)	HD 2932© (KAUZ/STAR//HD2643)	MP3336© (HD2402/GW173)
MP1224 (GW 275/LOK1//GW 275)	MP3304 (GW 322/J 485)	MP3336 (HD 2402/GW 173)	GW 433 (WR 196/CMH 832978)	MP3379 (RAJ 3777/DL 788-2)	HD 2864© (DL509-2/DL377-8)	HD2932© (KAUZ/STAR//HD26 43)
MP4106 (CHIBIA/PRL 11/CM 65531)	HD2864# (DL 509-2/DL 377-8)	HUW648 (HD 2733/MACS 2496//HW 2045)	UP 2824 (HUW 434/HD 2857)	MP4010© (ANGOSTURA 88)	MP 3336© (HD2402/GW173)	MP4010© (ANGOSTURA88)
MP1203(I)# (FANS/2*TEPOCA/3/CHEN/AEGI LOPS SQUARROSA/TA)	HD2932# (KAUZ/STAR//HD 2643)	CG8001 (DBW 10/WH 542)	HD 3095 (CPAN 3004/WR 426//HW 2007//HD 2851)	HD2932© (KAUZ/STAR//HD2643)	MP 4010© (ANGOSTURA88)	HD 2864© (DL 509-2/DL 377-8)
MP4010# (ANGOSTURA 88 (CM 50123-3M-Y-2M-1Y-2M-Y-2M-2Y-OM-OMR/S)	MP4010# (ANGOSTURA 88(CM 50123-3M-Y-2M-1Y-2M-Y-2M-2Y-OM-OMR/S)	HD2864© (DL 509-2/DL 377-8)	RAJ 4238* (HW 2021/RAJ 3765)	HD 2864© (DL 509-2/DL 377-8)		
GW173# (TW 275/7/7/10/LOK1)	DL788-2# (K7537/HD 2160/HD2278//L24 K-4-14)	HD2932© (KAUZ/STAR//HD 2643)	RAJ 4250 (PBW 343/NW 2044/PBW 343)	MP3336(I)© (HD 2402/GW173)		
HD2864# (DL 509-2/DL 377-8)		DL-788-2© (K 7537/HD2160/HD 2278//L 24 K-4-14)	MP 4010© (ANGOSTURA 88(CM 50123-3M-Y-2M-1Y-2M-Y-2M-2Y-OM-OMR/S)	RAJ 4238(I)© (HW 2021/RAJ 3765)		
HD2932# (KAUZ/STAR//HD 2643)		MP4010© (ANGOSTURA 88(CM 501123-3M-Y-2M-1Y-2M-Y-2M-2Y-OM-OMR/S)	HD 2864© (DL 509-2/DL 377-8)			
DL788-2# (K 7537/HD 2160/HD 2278//L 24K-4-14)			HD 2932© (KAUZ/STAR//HD 2643)			

Table 6: Genotypes along with parentage details for restricted irrigated timelysown trials

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2016-17	2017-18
HI8696@(RAJ6070/RAJ 911)	HI1572 (SKAUZ*2/FCT)	HI 1572 (SKAUZ*2/FCT)	MP 1255 (D)(ALTAR 84/STINT//SILVAR 45/3/)	GW1292 (D)(HI 8550/GW1173//DWR 2015)	DBW110* (KIRITATI/4/2*SERI1 B*2/3/KAUZ*2/BOW// KAUZ)	BRW3775 (PFAU/SERI.1B//AM AD/3/WAXWING/4/ BABAX/LR42//BAB AX*/3/KURUKU)	DDW47 (D)(PBW34/RAJ1555//PDW314)
HI8699@(WH 921/HI 8498)	MP1230 (HW 2004/1BWSN 166//GW 190/HW 2023/HDR 199)	HI1579 (KAUZ//ALTAR 84/AOS/3/MILAN/KAUZ/4 /HUITES)	UAS 442 (D)(CBC 501 CHILE/4/SKEST//HUI/TUB/3/ SILVER)	HI8731(D)* (JAIRAJ/HD4672//HD4672)	HD 3146 (HUW510/CBW17)	UAS385 (GW344/UAS239/DW R162)	MP1331 (PBW343*2/KUKUNA//KITE)
HD2987*(HI1011/HD 2348//MENDOS//IWP 72/DL 153-2)	MP3288* (DOVE/BUC/DL 788-2)	HI1580 (HD 2402/HW 3007)	HP 1940 (PBW 337/DBW 14)	MACS 6568 (GW 322/K9644//RAJ 4037)	HI 1500© (HW 2002*2//STRE M PAL L I /P N C5)	UAS462(D) (DWR1006/HI8671// UAS415)	UAS466 (D)(AMRUTH//BIJAGA YELLOW/AKDW299-16)
GW1245@*(GW 1034/OMGUER-5))	MP3299 (DOVE/BUC/DL 788-2)	JWS134 (HI 385 /WR 251)	MP 1256(D) (ALTAR/STINT//SILVER/3/P OHO)	MPO1215(D)* (GW 1113/GW1114//HI8381)	MP 3288© (DOVE/BUC/DL 788-2)	HI8791(D) (HI1531/HI8498//HI8 627)	NIAW3170 (SKOLL/ROLF07)
GW1250@(RAJ 3307/CPAN 6207//HI8498)	HI8708(D) (HG 822XHI8498)	RKD216 (CBC 509 CHILE/SOMAT 3.1//WODUCK/CHAM 3)	GW 1280(D) (DL 18/MACS 2526//MACS 2526)	NIAW 1885 (ALTAR 84/AE. SQUARROSSA/TAUS//OP ATA/3/ATTILA)	HI 8627(D)© (HD4672/PDW233)	HI8627(D)© (HD4672/PDW233)	DBW110© (KIRITATI/4/2*SERI1B*2/3/K AUZ*2/BOW//KAUZ)
NIAW1395 (NIAW 34/HD 2189//NIAW 34/HW 2022)	HI8709(D) (HD 4672XPDW 233)	MP1242 (HW 2004/IBWSN 188//GW 190/3/GW 190/HW 2003/HDR 199)	HI 8730(D) (HI 8623/HI 8381//WH 896)	K1116 (HD 2888/K9351)		MP3288©(DOVE/BUC/DL788-2)	MP3288© (DOVE/BUC/DL788-2)
MP1218 (MP 1052/RAJ 4001)	GW1260(D) (GW 1019/D/91-70-1-1//MOYE'S'/AO'S'/4/FORGE T'S'/3/RAJ 6427)	DBW74 (RWP 2008-26/WBLLL*2/BRAMBLIN G)	HI 8731 (D)(JAIRA/HD 4672//HD 4672)	DBW110 (KIRITATI/4/2*SERI1B*2/ 3/KAUZ*2/BOW//KAUZ)		DBW110© (KIRITATI/4/2*SERI 1B*2/3/KAUZ*2/BO W//KAUZ)	HI8627(D)© (HD4672/PDW233)
MPO1220@(GW 1167/RAJ 6550)	MPO1232(D) (GW 1167/RAJ 6550)	KD0921 (A9-30-1/KATHIA LOCAL)	HI 8627(D)© ((HD 4672/PDW 233)	PBW689 (PBW 442/WH576//DWR232)			
MP3288 (DOVE/BUC/DL 788-2)	UAS431(D) (PORTO_3/3//SORA/2*PLA TA_12/DWR 185)	HI8722(D) (BRED/PBW 34//ALTAR 84)	A 9-30-1 (D)©(A 206/GAZA)	HI8742(D) HI 8656/HG110)			
FILLER (	UAS432(D) (YAVAROS 79//DWR 174/DWR 185)	MPO1243 (D)(GW 1167/RAJ 6550)	HI 1500© (HW 2002*2//STREMPALLI/PNC5)	WH1142 (OEN/AE.SQ.(TAUS)/FCT/ 3/2*WEAVER)			
TL 2966(DT57/TL 2619//JNIT141/3/TL 2902)	HD4672(D)# (BRED/PBW 34//ALTAR 84)	DDW19(D) (DSP 49/RAJ 1555)		HD3123 (PASTOR//HXL 7573/2* BAU/3/CMH 82. 575/CMH 82.801)			
LOK1# (S 308/S 331)	HI8627(D)# (HD 4672/PDW 233)	HI1500© (HW 2002*2//STREMPALLI/PN C 5)		MACS3915(D) (MACS 2846/NIDW 15)			
HI1531# (HI 1182/CPAN 1990) HW2004#(C 306*7/TR 380-14*7/3 AG 14)	HI1531# (HI 1182/CPAN 1990) HI1500# (HW 2002*2 // STREMPALLI/PNC 5)	HI8627(D)© (HD 4672/PDW 233) A9-30-1(D)© (A 206/GAZA)		UAS348 (K9644/HD2189//GW322) UAS446(D) (DWR 185/DWR 2006//UAS 419)			
HD4672@#(BRED/PBW 34//ALTAR 84)	LOK1# (S 308/S 331)	MP3288(I) (DOVE/BUC/DL/788-2)		HI1500© (HW 2002*2//STREMPALLI/PN C5)			
HI8627@#(HD 4672/PDW 233)				MP3288© (DOVE/BUC/DL 788-2) HI8627(D)©(HD 4672/PDW 233) A9-30-1(D)©(A 206/GAZA)			

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