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Research Article

# PROMISING AMERICAN COTTON (*G. hirsutum*) GERMPLASM FOR GINNING OUTTURN

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**Abstract:** The ginning outturn is the most important trait to decide the lint yield. The lower ginning outturn is the reason for lower lint yield in the zone and need immediate attention. 3954 geographically and phenotypically diverse lines of *G. hirsutum* were screened during 2013-14 to 2015-16 for 3 years for ginning outturn, seed cotton yield and yield contributing traits. A wide range of variability for ginning outturn from 21.7 - 42.0 percent, yield/plant 50.4 -129.8g, number of monopodia 0-13, number of sympodia 0-23, number of bolls/plant 5-47, incidence of CLCuD 0-100 percent were observed in the germplasm. Among the 100 accessions with ginning outturn above 40 percent, the accessions IC 359065 (42), SA 1006 (42), IC 359429 (42), IC 359660 (42) and IC 359383 (42) were observed superior. Among these, the superior accession for yield/plant were IC 359383 (129.2g), IC 359429, for boll number IC 359383 (44), IC 357487 (31), IC 359660 (26), for boll weight SA 1006 (3.58g), IC 359706 (3.5g), IC 359660 (3.5g), for number of monopodia SA 1006 (9), IC 359383 (4), IC 357487 (3); for number of sympodia IC 359429 (15) IC359383 (14), IC 359227 (11) and for tolerance to CLCuD IC 357726, IC 358479, IC 357856 were observed . These can be used for crop improvement programs.

**Keywords:** *Cotton germplasm, Ginning outturn, Gossypium hirsutum, Yield*

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## Introduction

Cotton is a major fibre crop of global importance which belongs to genus *Gossypium* in the family *Malvaceae*. In India it is a most important commercial crop which provides employment to millions of people for different activities such as research, seed production, marketing, industrial utilization etc. In India it is being grown in around 105.0 lakh ha area with production of 351 lakh bales. The productivity in India (568 kg lint/ha) is low in comparison to word average (788 kg/ha) and that of Brazil 1522 kg/ha, China (1719 kg/ha) and USA (974 kg/ha) [1]. Among the various traits which contribute to lint yield, the ginning outturn is a most important parameter. In all the varieties/hybrids released for cultivation in India, the ginning out turn is around 35-38 percent against around 43.0% in various other countries such as Bangladesh [2]. The extra-long staple cotton varieties such as Suvin has reported low ginning outturn of 29 percent, hence the average lint yield of Suvin in comparison to *G. hirsutum* hybrids and varieties is lowest [3].

North zone is an important cotton growing zone in the country and the upland cotton is the dominant species cultivated in more than 95 percent area. In this zone cotton is being cultivated in around 11.96 lakh ha area with production around 40.40 lakh bales and productivity 668.0 kg/ha [4]. In this zone the productivity is fluctuating i.e. in 2012-13 (704 Kg/ha), 2013-14 (729 Kg/ha), 2014-15 (579 Kg/ha.), 2015-16 (459 Kg/ha) and 2016-17 (668 Kg/ha). As per the information available in package of practice of North zone Universities, in all the *G hirsutum* varieties released for cultivation under north zone the ginning out turn is below 35 percent. It is a reason for the lower lint yield of this zone and need immediate attention. However, the ginning outturn in the Bt hybrids evaluated under North zone was observed from 33 to 37 percent, which may be helpful in improving the lint yield in the zone [5]. Cotton germplasm is the basic source for improvement of desired traits. To improve the ginning outturn of existing cultivars, it is necessary to generate information on genetic variability in germplasm for ginning outturn along with higher yield potential and tolerance to cotton leaf curl disease (CLCuD). In *G. hirsutum* germplasm evaluated under Central zone at CICR Nagpur, some of the lines were reported with high ginning outturn (%) IC 371425 (39.6), IC 371457 (39.0), IC 371392 (38.9), IC371419 (38.9) and IC371376 (38.8), but for the North zone such information is not available. Keeping this in view, evaluation of geographically and phenotypically diverse lines from the gene pool of *G. hirsutum* cotton was made under this zone to screen the superior lines for ginning outturn along with higher yield potential.

## Materials and methods

Three thousand nine hundred fifty-four geographically and phenotypically diverse *G. hirsutum* lines were evaluated for three consecutive years under North zone during 2013-14 to 2015-16 to screen the superior lines for ginning outturn along with yield and yield contributing traits and incidence of CLCuD. These lines were supplied for the first time from a gene pool maintained at Nagpur to evaluate under North zone condition. Each accession was sown in a single row with 10 dibbles at 67.5 x 30 cm spacing adopting all recommended agronomic and plant protection measures. Observations on ginning outturn, yield per plant and several yields contributing parameters i.e. number of bolls per plant, boll weight, number of monopodia, number of sympodia, and reaction for CLCuD were recorded. The range of different parameters was worked out and ten superior genotypes for ginning outturn were identified.

## Result and discussion

The ginning outturn is the most important trait to decide the lint yield. In the *G. hirsutum* varieties/hybrids under cultivation in North zone, the ginning out turn is lower than 38 percent. The lower ginning outturn is the reason for lower lint yield in the zone and need immediate attention. The effectiveness of selection for desired traits depends on the amount of range of variability for each parameter available in the germplasm accessions.

Table-1 Germplasm accession for higher ginning outturn and their yield

| IC/EC NO. | GOT | yield/plant (gm) | No. of bolls/plant | Boll wt (gm) | No. of monopodia | No. of sympodia | CLCvD % |
|---|---|---|---|---|---|---|---|
| IC – 359227 | 41.9 | 50.4 | 15 | 3.36 | 2 | 11 | 66.7 |
| IC – 358382 | 41.2 | 50.6 | 23 | 2.30 | 3 | 7 | 0.0 |
| BMK 3 | 40.0 | 50.9 | 16 | 3.18 | 3 | 9 | 25.0 |
| IC – 357726 | 41.9 | 51.3 | 18 | 2.85 | 2 | 8 | 0.0 |
| IC – 357673 | 41.7 | 51.5 | 14 | 3.68 | 5 | 7 | 66.7 |
| IC – 358479 | 41.9 | 52.7 | 17 | 3.10 | 0 | 9 | 0.0 |
| NAAC – 1 | 40.0 | 53.6 | 16 | 3.35 | 3 | 7 | 100.0 |
| SA -115 | 41.5 | 54.4 | 16 | 3.40 | 1 | 14 | 0.0 |
| IC – 3588 65 | 41.8 | 54.4 | 17 | 3.20 | 13 | 4 | 100.0 |
| IC – 357461 | 41.2 | 57.0 | 17 | 3.35 | 4 | 8 | 25.0 |
| IC – 359454 | 41.2 | 58.7 | 17 | 3.45 | 9 | 6 | 40.0 |
| IC – 356666 | 41.1 | 59.2 | 17 | 3.48 | 7 | 9 | 20.0 |
| IC – 359714 | 41.4 | 59.9 | 21 | 2.85 | 0 | 9 | 0.0 |
| IC – 358081 | 41.2 | 61.2 | 18 | 3.40 | 2 | 9 | 0.0 |
| IC 358187 | 41.5 | 61.2 | 17 | 3.60 | 1 | 12 | 66.7 |
| DCI -438 | 40.6 | 61.7 | 18 | 3.43 | 9 | 16 | 11.1 |
| IC – 359199 | 40.3 | 62.6 | 21 | 2.98 | 1 | 8 | 0.0 |
| IC – 359372 | 40.7 | 62.6 | 21 | 3.00 | 1 | 8 | 0.0 |
| 99006 | 40.9 | 62.6 | 18 | 3.48 | 8 | 5 | 20.0 |
| IC – 357856 | 41.9 | 62.9 | 22 | 2.86 | 2 | 9 | 0.0 |
| IC – 359706 | 41.9 | 63.0 | 18 | 3.50 | 0 | 8 | 80.0 |
| IC – 357589 | 41.3 | 64.4 | 5 | 2.10 | 1 | 4 | 100.0 |
| IC – 358210 | 41.2 | 64.4 | 19 | 3.39 | 1 | 15 | 0.0 |
| SA -145 | 40.0 | 64.4 | 19 | 3.39 | 0 | 16 | 16.7 |
| SA -372 | 40.0 | 64.6 | 19 | 3.40 | 1 | 12 | 16.7 |
| IC – 359484 | 40.8 | 65.1 | 21 | 3.10 | 0 | 13 | 0.0 |
| IC – 359838 | 41.9 | 65.7 | 18 | 3.51 | 4 | 9 | 0.0 |
| IC – 359516 | 41.4 | 65.7 | 19 | 3.46 | 5 | 8 | 0.0 |
| IC – 357591 | 41.1 | 66.1 | 19 | 3.50 | 4 | 1 | 100.0 |
| SA - 1023 | 41.2 | 66.1 | 19 | 3.48 | 4 | 8 | 0.0 |
| IC – 359671 | 41.4 | 66.2 | 24 | 2.76 | 0 | 8 | 16.7 |
| BMK -180 | 40.0 | 66.8 | 21 | 3.18 | 4 | 16 | 28.6 |
| IC – 356799 | 41.9 | 67.5 | 30 | 2.30 | 0 | 13 | 0.0 |
| IC – 357246 | 41.8 | 67.6 | 26 | 2.60 | 1 | 11 | 12.5 |
| IC – 357595 | 41.4 | 68.0 | 20 | 3.40 | 7 | 14 | 0.0 |
| IC – 359065 | 42.0 | 68.9 | 21 | 3.28 | 3 | 11 | 50.0 |
| IC – 357303 | 41.2 | 69.1 | 22 | 3.14 | 7 | 8 | 100.0 |
| IC – 358591 | 41.6 | 69.3 | 22 | 3.15 | 4 | 9 | 50.0 |
| IC – 359283 | 40.0 | 70.0 | 25 | 2.80 | 2 | 7 | 0.0 |
| IC – 359236 | 40.0 | 70.0 | 25 | 2.80 | 3 | 11 | 0.0 |
| GT – 325 | 40.0 | 70.2 | 23 | 3.05 | 2 | 10 | 0.0 |
| IC – 359327 | 41.9 | 71.0 | 21 | 3.38 | 4 | 8 | 0.0 |
| IC – 358590 | 41.9 | 71.3 | 23 | 3.10 | 4 | 10 | 50.0 |
| IC – 359428 | 41.9 | 71.8 | 21 | 3.42 | 7 | 4 | 50.0 |
| IC – 357458 | 40.3 | 72.0 | 36 | 2.10 | 5 | 14 | 0.0 |
| IC – 356607 | 41.5 | 72.5 | 23 | 3.15 | 7 | 6 | 0.0 |
| IC – 359105 | 41.9 | 72.6 | 22 | 3.30 | 1 | 8 | 0.0 |
| IC – 357204 | 41.5 | 72.8 | 28 | 2.60 | 5 | 10 | 0.0 |
| CPH -5747 | 41.0 | 73.2 | 24 | 3.05 | 4 | 10 | 83.3 |
| IC – 359413 | 41.3 | 74.8 | 22 | 3.40 | 4 | 8 | 0.0 |
| IC – 357932 | 41.0 | 75.0 | 25 | 3.00 | 11 | 6 | 50.0 |
| SA - 1006 | 42.0 | 75.2 | 21 | 3.58 | 9 | 7 | 100.0 |
| IC – 358448 | 41.2 | 76.6 | 22 | 3.48 | 5 | 17 | 60.0 |
| IC – 357739 | 40.6 | 76.6 | 31 | 2.47 | 7 | 11 | 0.0 |
| IC – 358317 | 40.7 | 77.0 | 28 | 2.75 | 4 | 12 | 0.0 |
| IC – 360029 | 41.4 | 77.4 | 22 | 3.52 | 3 | 9 | 100.0 |
| IC 358950 | 40.0 | 77.7 | 21 | 3.70 | 6 | 9 | 100.0 |
| IC – 359501 | 40.0 | 78.0 | 26 | 3.00 | 6 | 13 | 0.0 |
| IC – 356981 | 41.9 | 78.7 | 32 | 2.46 | 3 | 12 | 14.3 |
| IC – 357360 | 41.5 | 81.0 | 30 | 2.70 | 6 | 12 | 14.3 |
| IC 357845 | 40.0 | 82.8 | 23 | 3.60 | 7 | 9 | 80.0 |
| CBBRH-3 | 40.9 | 82.8 | 24 | 3.45 | 0 | 12 | 0.0 |
| IC – 359549 | 41.3 | 83.5 | 24 | 3.48 | 9 | 5 | 100.0 |
| IC – 358287 | 41.5 | 83.7 | 27 | 3.10 | 6 | 13 | 20.0 |
| IC – 359522 | 41.1 | 84.0 | 28 | 3.00 | 1 | 11 | 42.9 |
| IC – 359165 | 41.0 | 84.0 | 13 | 2.00 | 3 | 4 | 14.3 |
| SA -373 | 41.9 | 84.7 | 24 | 3.53 | 10 | 7 | 0.0 |
| IC – 359443 | 41.2 | 86.5 | 25 | 3.46 | 4 | 23 | 33.3 |
| IC – 357487 | 42.0 | 86.8 | 31 | 2.80 | 3 | 11 | 33.3 |
| ABGMS –7 | 40.0 | 89.9 | 29 | 3.10 | 3 | 11 | 0.0 |
| IC – 359660 | 42.0 | 91.0 | 26 | 3.50 | 2 | 10 | 100.0 |
| IC – 357497 | 41.9 | 92.4 | 33 | 2.80 | 7 | 10 | 75.0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| IC – 357185 | 41.2 | 93.0 | 31 | 3.00 | 8 | 12 | 100.0 |
| IC – 359026 | 41.8 | 94.5 | 29 | 3.26 | 2 | 12 | 66.7 |
| SA - 1394 | 41.9 | 98.0 | 28 | 3.50 | 9 | 8 | 0.0 |
| IC – 359400 | 41.5 | 98.6 | 29 | 3.40 | 6 | 12 | 100.0 |
| SA - 1456 | 41.9 | 88.2 | 28 | 3.58 | 0 | 12 | 60.0 |
| N – 66 | 40.7 | 100.3 | 29 | 3.46 | 2 | 11 | 20.0 |
| IC – 359659 | 41.2 | 100.6 | 29 | 3.47 | 5 | 9 | 40.0 |
| KIRGHIS K2-B | 40.6 | 102.9 | 30 | 3.43 | 8 | 16 | 16.7 |
| IC – 359835 | 40.0 | 103.7 | 34 | 3.05 | 3 | 11 | 0.0 |
| IC – 359275 | 41.3 | 94.5 | 31 | 3.37 | 0 | 12 | 42.9 |
| IC – 358255 | 41.2 | 105.4 | 31 | 3.40 | 2 | 12 | 50.0 |
| IC – 359132 | 41.9 | 105.6 | 32 | 3.30 | 4 | 13 | 0.0 |
| SA- 1588 big Boll | 40.0 | 105.9 | 30 | 3.53 | 4 | 10 | 14.3 |
| SA – 582 | 40.5 | 107.9 | 31 | 3.48 | 3 | 14 | 20.0 |
| IC – 358738 | 41.9 | 96.1 | 34 | 3.18 | 0 | 12 | 50.0 |
| VC – 8 | 40.0 | 108.9 | 33 | 3.30 | 4 | 12 | 22.2 |
| IC – 359737 | 41.2 | 112.2 | 33 | 3.40 | 1 | 12 | 0.0 |
| IC – 359725 | 41.2 | 112.2 | 15 | 3.05 | 2 | 9 | 0.0 |
| IC – 357319 | 41.8 | 112.6 | 42 | 2.68 | 6 | 14 | 50.0 |
| IC – 359317 | 41.7 | 100.6 | 34 | 3.37 | 0 | 12 | 37.5 |
| SA - 1150 | 40.5 | 115.6 | 31 | 3.60 | 1 | 10 | 50.0 |
| IC 359008 | 40.9 | 115.6 | 31 | 3.73 | 0 | 10 | 50.0 |
| IC – 356680 | 40.3 | 116.4 | 33 | 0.00 | 5 | 20 | 0.0 |
| SA -383 | 40.0 | 119.0 | 35 | 3.40 | 2 | 15 | 57.1 |
| IC – 357053 | 41.3 | 123.9 | 42 | 2.95 | 2 | 13 | 50.0 |
| IC – 359429 | 41.7 | 108.4 | 22 | 3.43 | 3 | 15 | 66.7 |
| IC – 359348 | 41.4 | 108.4 | 38 | 3.38 | 2 | 15 | 66.7 |
| SA - 1332 | 40.7 | 127.3 | 37 | 3.71 | 13 | 13 | 0.0 |
| SA - 1690 | 40.0 | 127.0 | 42 | 3.50 | 4 | 13 | 66.7 |
| IC – 359424 | 40.0 | 127.0 | 42 | 3.50 | 4 | 11 | 66.7 |
| IC – 359383 | 41.7 | 129.2 | 44 | 3.39 | 4 | 14 | 40.0 |
| IC – 358988 | 40.0 | 127.5 | 44 | 3.58 | 9 | 4 | 0.0 |
| IC – 359601 | 41.4 | 124.0 | 47 | 3.49 | 4 | 16 | 12.5 |
| Range | 21-42.0 | 50.4-129.8 | 5-47 | 2.0-3.7 | 0-13 | 1-23 | 0-100 |

Table-2 Superior lines for ginning outturn, yield and reaction to CLCuD

| Accessions | Ginning Outturn | yield/plant (gm) | No. of bolls/plant | Boll wt (gm) | No. of monopodia | No. of sympodia | CLCvD % |
|---|---|---|---|---|---|---|---|
| SA - 1006 | 42.0 | 75.2 | 21 | 3.58 | 9 | 7 | 100.0 |
| IC – 359065 | 42.0 | 68.9 | 21 | 3.28 | 3 | 11 | 50.0 |
| IC – 359429 | 42.0 | 108.4 | 22 | 3.43 | 3 | 15 | 66.7 |
| IC – 359660 | 42.0 | 91.0 | 26 | 3.50 | 2 | 10 | 100.0 |
| IC – 357487 | 42.0 | 86.8 | 31 | 2.80 | 3 | 11 | 33.3 |
| IC – 359383 | 42.0 | 129.2 | 44 | 3.39 | 4 | 14 | 40.0 |
| IC – 359227 | 41.9 | 50.4 | 15 | 3.36 | 2 | 11 | 66.7 |
| IC – 358479 | 41.9 | 52.7 | 17 | 3.10 | 0 | 9 | 0.0 |
| IC – 359706 | 41.9 | 63.0 | 18 | 3.50 | 0 | 8 | 80 |
| IC – 357726 | 41.9 | 51.3 | 18 | 2.85 | 2 | 8 | 0.0 |

A wide range of variability for each trait was observed in the germplasm involved in the study. The range of variability for ginning outturn in the evaluated three thousand nine hundred fifty-four accessions was observed from 21.7 - 42.0 percent. Out of 3954 germplasm accessions, 100 superior accessions with ginning outturn above 40 percent were screened from the widely variable population [Table-1]. Among these, the accessions SA 1006 (42%), IC 359065 (42%), IC 359429 (42%), IC 359660 (42%), IC 357487 (42%) and IC 359383 (42%) were observed superior for ginning outturn [Table-2]. In the study material, the range for yield/plant was observed from 50.4 -129.2g. Generally, the negative correlation of ginning outturn with yield was observed in cotton [6]. However, the superiority for yield per plant in accessions IC 359383 (129.2g), IC 359429 (108.4g), IC 359660 (91g), IC 357487 (86.8) and SA 1006 (75.2g) was observed in combination of ginning outturn of 42%. In cotton, the positive correlation of yield per plant with boll number was observed by several workers [7, 8]. In germplasm the range for the number of bolls/plant was observed 5-47. Among the 10 superior accessions identified for ginning outturn, the higher number of bolls was observed in IC 359383 (44), IC 357487 (31), IC 359660 (26), IC 359429 (22) and SA 1006 (21). The cotton boll weight is one of the important traits for developing high yielding genotypes, because it has positive linkage with seed index and seed cotton yields both at genotypic and phenotypic level [9]. The range for this parameter was 2-3.7 g. Among 10 superior accessions for ginning outturn, the superior accessions observed for boll weight were SA 1006 (3.58g), IC 359706 (3.5g), IC 359660 (3.5g), IC 359429 (3.43g) and IC 359383 (3.39g) observed with higher boll weight [Table-2]. The range for number of monopodia was 0-13. Among superior accessions for ginning outturn, the accessions SA 1006 (9), IC 359383 (4), IC 357487 (3), IC 359065 (3g), and IC 359429 (3) were observed with more number of monopodia. As experienced, in North zone the yield potential of cultivars with less monopodia and higher number of sympodia being observed higher because the retention of bolls in plant with open canopy is generally higher. Feiyh, *et al*., [10] also noticed in China that reduced plant height, short branches, modified leaves, and combinations of these characteristics grown at high plant densities could be a good alternative to increase the yield of cotton. Among the total accessions involved in study the range was observed from 0 to 23 numbers of sympodia. However, among 10 superior accessions identified for ginning outturn the superior for number of sympodia were IC 359429 (15) IC359383 (14), IC 359227 (11), IC 357487 (11), IC 359065 (11) [Table-2]. The CLCuD is the serious threat for north zone and among superior accessions for ginning outturn. In the evaluated germplasm, for CLCuD susceptibility of accessions was observed from 0 to 100 percent. The accession IC 357726, IC 358479, IC 357856, IC 359838, IC 356799 were observed with zero incidence of CLCuD. The identified superior lines for ginning outturn with combination of various important traits can be used for cultivation as well as for improvement of desired traits. The superior among these for fibre length (mm), fibre strength (g/tex) and micronaire value were IC 359317 (28.0, 20.3 and 3.9), IC 359295 (26.0, 19.4 and 5.0) and IC 359429 (26.0, 21.3 and 3.9). These can be used for crop improvement programs.

**Application of research:** The superior accessions can further be utilized in cotton varietal improvement programmes by the breeders.

**Research Category:** Cotton germplasm for ginning outturn

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