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Research Article

EVALUATION OF WHEAT GENOTYPES IN FAR WESTERN HILLS OF NEPAL

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Abstract

Coordinated Varietal Trial (CVT) and Advanced Varietal Trial (AVT) of wheat were conducted at Regional Agricultural Research Station, Doti during the year 2012 and 2013. Microplot Yield Trial (MPYT) were conducted during the year 2013. Total 20 genotypes were included in CVT experiment of both years. Although the difference in grain yield due to genotypes was not found significant during the year 2012, NL 1144 recorded the highest grain yield (4309 kg/ha) followed by NL 1140 (4295 kg/ha) and NL 1147 (4165 kg/ha) respectively. But in the year 2013, NL 1097 produced the highest grain yield (4641 kg/ha) followed by NL 1135 (4383 kg/ha) and NL 1164 (4283 kg/ha) respectively. Statistically, the difference in grain yield due to genotypes was not found significant in the year 2013. Combined analysis over years was also carried out. Out of 20, only 10 genotypes were included in the CVT experiment, which were found similar in both years. Genotypes NL 1097 (4079 kg/ha), NL 1140 (3814 kg/ha) and NL 1093 (3773 kg/ha) were found high yielding genotypes for river basin agro-environment of far western hills. Statistically, effect of year in tested characters was found significant whereas treatment effect was observed non-significant. Similarly, 20 genotypes of wheat were included in AVT of wheat during the year 2012 and 2013. Out of the genotypes included in AVT during the year 2012, KISKADEE No.1 recorded the highest grain yield (3824 kg/ha) followed by CHEWINK No. 1 (3643 kg/ha) and WK 2120 (3583 kg/ha). Statistically all the tested characters except grain yield were found significantly different due to genotypes. But in the same experiment of the year 2013, WK 2412 genotype recorded the highest grain yield (4407 kg/ha) followed by WK 2411 (4329 kg/ha) and Munal-1 (4054 kg/ha). Statistically the difference in grain yield and other tested characters were found significantly different. Due to dissimilarity in the tested genotypes we could not carry-out the combined analysis over years. Total 30 genotypes were included in the MPYT experiment of the year 2013. Genotype WK 2272 recorded the highest grain yield (6080 kg/ha) followed by the genotypes WK 2274 (5152 kg/ha) and WK 2278 (4880 kg/ha) respectively. Statistically, the difference in grain yield and other tested characters were found significantly different due to genotypes.

Keywords: Wheat genotypes; evaluation; CVT; AVT; MPYT; FFT; PVS; grain yield; far western hills

Introduction

Wheat (Triticum aestivum) is the third most important cereal crop in terms of area (754243 ha) and production (1727246 Mt) of the nation. But, wheat is the first crop in area coverage (52192 ha) and production (101045 Mt) in far western hills. The average productivity of wheat in far western hills is 15.45% lower (1936 kg/ha) compared to its national average productivity (2290 kg/ha). Among the total cultivated area (3091000 ha) of the country, about 67% cultivated area (759579 ha) is under rainfed agro-ecosystem. Due to low productivity of wheat, its input/output ratio in irrigated and un-irrigated condition is only 1.216 & 1.275 respectively (MoAD, 2012/13). Out of the tested entries of wheat during 2009/10, WK 1806 produced the highest grain yield (3250 kg/ha) followed by 3EBWYT514 and WK 1204 (3041 kg/ha) in Doti district whereas in Dadeldhura district, the genotype WK 1789 produced the highest grain yield (2500 kg/ha) followed by the genotypes 3EBWYT 515 (2468 kg/ha) and WK 1204 (2166.67 kg/ha) respectively. These promising genotypes of wheat produced 28-36% higher grain yield than the farmers’ local in Doti district and 32-53% higher grain yield compared to farmers’ local in Dadeldhura district (HK Prasai et al, 2011).

NL 1097 (4079 kg/ha), NL 1140 (3814 kg/ha), NL 1093 (3773 kg/ha) and NL 1135 (3620 kg/ha) genotypes of wheat have been identified as promising for river basin agro-environment of far western hills. Similarly, Danphe-1 (5254 kg/ha), Munal-1 (5231 kg/ha) and Kiskadee (5202 kg/ha) genotypes of wheat have been identified as promising for mid hills agro-environment of far western hills (RARS, 2012/13).

The modern varieties and improved farming practices have had a large impact on improved crop cultivation. Most of the increased production and productivity came from the availability of high yielding varieties as farmers gradually replaced their low yielding traditional varieties with high yielding. This positive change in agricultural development...
has resulted from the technological progress, which helped to benefit to millions of people and contributed to sustaining food security in the face of growing population pressure to some extent on limited natural resources.

Materials and Methods

The Coordinated Varietal Trial (CVT) and Advanced Varietal Trial (AVT) were carried out at Regional Agricultural Research Station (RARS), Bhagetada, Doti in 2012 and 2013, whereas Micro plot Yield Trial (MPYT) was carried out during 2013. The experiments was located at altitude of 610 m above mean sea level on 29°15' north latitude and 80°55' east longitudes. The soil was light texture, low organic matter (1-2 %) and acidic in nature containing pH 6. All experiments were carried out in Randomized Complete Block Design. Total twenty genotypes namely BL 3819, NL 1042, NL 1044,NL1073,NL1093,NL 1094,NL1097,BL3814, BL 3978, BL 1009,NL 1133,NL 1135,NL 1136,NL 1140,NL 1144,NL 1143,NL 1147,Gautam,Bhrikuti and RR 21 were included in the CVT experiment of the year 2012. Similarly, BL 3978, BL 1009,NL 1093,NL 1097, NL 1135, NL 1140, NL1143, BL 4316, BL 4341, BL 4343, BL 4347, BL 4350, NL 1164, NL1169, NL1171, NL1172, NL1177, Gautam, Bhrikuti and RR 21 genotypes of wheat were included in the CVT experiment of the year 2013. These genotypes was seeded the plot size of 8 m² and it was replicated twice in both year.

Total 20 genotypes namely WK 2110, WK 2192, WK 1661, WK 2120, WK 1487, WK 2130, WK 2190, WK 2135, WK 2191, WK 1204, WK 2144, WK 2189, Chewink-1, WK 2137, Kiskadee-1, WK 2181, WK 2156, WK 2186, WK 2154 and Chyakhura-1 were included in the AVT experiment of the year 2012. Similarly, WK 1118, WK 1792, WK 2407, WK 2408, WK 1204, WK 2409, WK 2410, WK 2411, WK 2412, Munal-1, WK 1153, WK 2148, WK 2152, WK 2183, Chyakhura-1, WK 2123, WK 2180 and WK 1481 genotypes of wheat were included in the AVT experiment of the year 2013. The genotypes were seeded in the plot size of 4 m² and it was replicated three times in both years.

Total 30 genotypes of wheat namely WK 2208, WK 2216, WK 2244, WK 2245, WK 2246, WK 2248, WK 2284, WK 2254, WK 2259, WK 1204, WK 2261, WK 2272, WK 2273, WK 2274, WK 2278, WK 2290, WK 2291, WK 2293, WK 2294, Munal-1, WK 2296, WK 2297, WK 2189, WK 2245, WK 2413, WK 2408, WK 2414, WK 2415, WK 2412 and WK 1481 were included in micro-pot yield experiment carried out at RARS, Doti during the year 2013. These genotypes were seeded in the plot of 2 m² area and it was replicated three times.

The planting time of wheat for all trials was November for all years. The chemical fertilizers were applied at the rate of 80:60:40 NPK kg/ha in all experiments. Half dose of nitrogenous fertilizer and full dose of phosphorus and potash was applied as basal dose and remaining half dose of nitrogenous fertilizer was applied after 21 days of seeding, that is, after first irrigation. Irrigation was applied five times during the crop cycle. Cultural practices and plant protection measures were applied as per recommendation.

| S.N. | Genotypes | Heading days | Maturity days | Plant height (cm) | Grain yield (kg/ha) |
|------|-----------|--------------|--------------|------------------|-------------------|
| 1    | BL 3819   | 106.5        | 142.5        | 95               | 2665              |
| 2    | NL 1042   | 92.5         | 132          | 95               | 3869              |
| 3    | NL 1044   | 101          | 139          | 82               | 2193              |
| 4    | NL 1073   | 93           | 133          | 91               | 2848              |
| 5    | NL 1093   | 102          | 138          | 104              | 3676              |
| 6    | NL 1094   | 101          | 135          | 95               | 2780              |
| 7    | NL 1097   | 101          | 137.5        | 98               | 3517              |
| 8    | BL 3814   | 101.5        | 137          | 105              | 3034              |
| 9    | BL 3978   | 90           | 128.5        | 102              | 3330              |
| 10   | BL 1009   | 95           | 134          | 126.5            | 3430              |
| 11   | NL 1133   | 104.5        | 139          | 102.5            | 3084              |
| 12   | NL 1135   | 105.5        | 140.5        | 86.5             | 2887              |
| 13   | NL 1136   | 102          | 140          | 91.5             | 3723              |
| 14   | NL 1140   | 94           | 132          | 88.5             | 4295              |
| 15   | NL 1144   | 100          | 136          | 103.5            | 4309              |
| 16   | NL 1143   | 99.5         | 136          | 93               | 2469              |
| 17   | NL 1147   | 100.5        | 137.5        | 98.5             | 4165              |
| 18   | Gaulam    | 102          | 139          | 95               | 3279              |
| 19   | Bhrikuti  | 103          | 139          | 89               | 2285              |
| 20   | RR 21     | 92           | 131.5        | 103.5            | 3336              |
|      | F-test    | **           | **           | **               | NS                |
|      | CV %      | 0.59         | 0.93         | 6.29             | 12.90             |

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Result and Discussion

The results of the experimental trials showed that there was variation in growth, grain yield and yield components of wheat genotypes among and within years. Grain yield is resultant of genetic capacity, environmental conditions and agronomic practices. This trait is affected from yield components (Dogan, 2002; Pireivatlou et al., 2011); therefore yield and yield components could be considered and studied in breeding programs (Carew et al., 2009). Out of the genotypes included in the CVT experiment of the year 2012, NL 1144 recorded the highest grain yield (4309 kg/ha) followed by NL 1140 (4283 kg/ha), NL 1164 (4283 kg/ha), NL 1171 (4091 kg/ha) and NL 1093 (3676 kg/ha) respectively. Statistically, the difference in heading days, maturity days, and grain/spike were found significant whereas the differences in tested traits such as plant height, spikes/m² and grain yield was not found significant due to genotypes (Table 2). The high yielding genotype, NL 1097, produced 17.25% more grain yield compared to the grain yield of the standard check Gautam. Amongst the tested entries of the year 2013, NL 1097 produced the highest grain yield (4641 kg/ha) followed by NL1135 (4383 kg/ha), NL 1135 (4383 kg/ha), NL 1140 (4283 kg/ha), NL 1171 (4091 kg/ha) and BL 4316 (4000 kg/ha) respectively. Statistically, the difference in heading days, maturity days, and grain/spike were found significant whereas the differences in tested traits such as plant height, spikes/m² and grain yield was not found significant due to genotypes (Table 2). The high yielding genotype, NL 1097, produced 17.25% more grain yield compared to the grain yield of the standard check Gautam.

NL 1097 (4079 kg/ha), NL 1140 (3814 kg/ha) and NL 1093 (3773 kg/ha) genotypes of wheat identified as promising from the combined analysis over year (2012-2013). Statistically, the effect of treatment in days to heading and maturity was found significant whereas effect of year in the tested characters was observed significantly different. Grain number per spikelet was considered as the main yield component in wheat by Hsu and Walton (1971). It was found significant for years and interaction between years and genotypes but non-significant for genotypes (Table 3).

Table 2: Grain yield and other ancillary characters of wheat genotypes in CVT during 2013

| S.N. | Genotypes | Heading days | Maturity days | Plant height (cm) | Spikes/m² | Grains/spike | Grain yield (kg/ha) |
|------|------------|--------------|---------------|------------------|-----------|--------------|--------------------|
| 1    | BL 3978    | 93           | 134.5         | 98.45            | 68.7      | 36.25        | 3450               |
| 2    | NL 1093    | 109.5        | 145           | 105.5            | 67.2      | 48.95        | 3950               |
| 3    | NL 1094    | 109          | 140           | 102.35           | 65.75     | 54           | 3583               |
| 4    | NL 1097    | 107          | 146.5         | 102.6            | 81.85     | 39.4         | 4641               |
| 5    | NL 1135    | 111.5        | 147.5         | 93.1             | 60.45     | 46.25        | 4383               |
| 6    | NL 1140    | 100          | 135.5         | 98.35            | 81.6      | 30.5         | 3333               |
| 7    | NL 1143    | 105.5        | 140           | 100.75           | 78.35     | 47.25        | 3716               |
| 8    | BL 4316    | 103.5        | 143           | 104.6            | 69.35     | 63.5         | 4000               |
| 9    | BL 4341    | 105          | 140.5         | 108.45           | 64.6      | 33.25        | 2866               |
| 10   | BL 4343    | 99.5         | 143           | 98.6             | 70.75     | 43.15        | 3691               |
| 11   | BL 4347    | 107          | 141.5         | 105.25           | 70.95     | 42.25        | 3483               |
| 12   | BL 4350    | 108          | 142           | 100.35           | 56.5      | 47.6         | 3199               |
| 13   | NL 1164    | 102.5        | 140.5         | 109.7            | 61.95     | 46.4         | 4283               |
| 14   | NL 1169    | 104          | 138.5         | 102.85           | 69.2      | 41           | 3883               |
| 15   | NL 1171    | 107.5        | 142           | 103.6            | 68.5      | 41.25        | 4091               |
| 16   | NL 1172    | 98           | 140.5         | 100.6            | 68.2      | 31           | 3516               |
| 17   | NL 1177    | 110          | 147           | 102.45           | 67.85     | 37.15        | 3616               |
| 18   | Gautam     | 108          | 146           | 109.5            | 63.1      | 4135         | 3958               |
| 19   | Bhrikuti   | 110.5        | 147           | 93               | 46.75     | 43.5         | 3533               |
| 20   | RR 21      | 106          | 143.5         | 108.35           | 65.7      | 26.95        | 3076               |
|      | F-test     | **           | **            | NS               | NS        | *            | NS                 |
|      | CV %       | 2.68         | 2             | 4.85             | 20.23     | 18.28        | 14.25              |
|      | LSD0.05    | 5.91         | 5.95          |                   |           |              |                    |

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Table 3: Combined analysis of grain yield and other ancillary characters of wheat genotypes over years (2012-2013)

| S.N. | Genotypes | Heading days | Maturity days | Plant height (cm) | Spikes/m² | Grains/spike | Grain yield (kg/ha) |
|------|-----------|--------------|---------------|-------------------|-----------|--------------|--------------------|
| 1    | BL 3978   | 91.5         | 131.5         | 100.22            | 68.85     | 31.95        | 3390               |
| 2    | NL 1093   | 104.75       | 140.25        | 105               | 60.35     | 35.17        | 3773               |
| 3    | NL1044    | 105          | 137.5         | 98.67             | 64.12     | 39.62        | 3182               |
| 4    | NL1097    | 104          | 142           | 100.3             | 72.92     | 32.47        | 4079               |
| 5    | NL 1135   | 108.5        | 144           | 89.8              | 87.47     | 34           | 3620               |
| 6    | NL 1140   | 97           | 133.75        | 93.42             | 86.55     | 33.55        | 3814               |
| 7    | NL 1143   | 102.5        | 138           | 96.87             | 76.67     | 38.57        | 3105               |
| 8    | Gautam    | 105          | 142.5         | 102.25            | 61.3      | 32.57        | 3619               |

Table 4: Grain yield and other ancillary characters of wheat in AVT during 2012

| S.N. | Genotypes | Heading days | Maturity days | Plant height (cm) | Grain yield (kg/ha) |
|------|-----------|--------------|---------------|-------------------|---------------------|
| 1    | WK 2110   | 99.33        | 146           | 116.67            | 3354                |
| 2    | WK 2192   | 114.33       | 148.67        | 122.33            | 2882                |
| 3    | WK 1661   | 100          | 139.33        | 101               | 3368                |
| 4    | WK 2120   | 99.67        | 142.67        | 118               | 3585                |
| 5    | WK 1487   | 98.33        | 142           | 125               | 3036                |
| 6    | WK 2130   | 109.67       | 149           | 93.67             | 2995                |
| 7    | WK 2190   | 110.33       | 151.33        | 87                | 2992                |
| 8    | WK 2135   | 100          | 139.33        | 91                | 2985                |
| 9    | WK 2191   | 106.33       | 146.33        | 122.33            | 3097                |
| 10   | WK 1204   | 104          | 144           | 82.33             | 3038                |
| 11   | WK 2144   | 112.33       | 149           | 110.33            | 3290                |
| 12   | WK 2189   | 97.67        | 137.67        | 113               | 2604                |
| 13   | Chewink-1 | 102.67       | 140.33        | 99.67             | 3643                |
| 14   | WK 2157   | 98.67        | 139.33        | 117.33            | 2834                |
| 15   | Kiskadee-1| 102          | 141           | 100.33            | 3824                |
| 16   | WK 2181   | 101.67       | 140.33        | 99.33             | 2895                |
| 17   | WK 2136   | 96.67        | 138.67        | 120.67            | 3088                |
| 18   | WK 2186   | 102          | 141           | 101.67            | 3149                |
| 19   | WK 2154   | 99.33        | 139.67        | 98                | 3268                |
| 20   | Chyakhura-1| 102         | 139.67        | 99.33             | 3310                |
| F-test | **       | **          | **           | NS                |                     |
| CV % | 2.13      | 1.03         | 7.67          | 15.86             | 23.82               |
| LSD0.05 | 3.02     | 4.27         | 13.92         |                   |                     |

Total 20 genotypes of wheat were included in the AVT experiment of the year 2012. Out of the tested genotypes, Kiskadee-1 (3824 kg/ha), Chewink-1 (3643 kg/ha), WK 2120 (3585 kg/ha), WK 1661 (3368 kg/ha) and WK 2110 (3354 kg/ha) identified as promising genotypes of wheat. Statistically, all traits included in the experiment except grain yield were found significantly different due to genotypes (Table 4). These promising genotypes produced 10.40 to 25.87% higher grain yield compared to standard check variety WK 1204. Out of the genotypes included in the AVT experiment during the year 2013, WK 2412 (4407 kg/ha), WK 2411 (4329 kg/ha), Munal-1 (4054 kg/ha), WK 2408 (4007 kg/ha) and WK 2123 (4002 kg/ha) identified as promising genotypes of wheat by producing more than 4Mt/ha. Statistically, the differences in days to heading, days to maturity plant height, spikes/m², grains/spike and
grain yield was found significantly different due to genotypes (Table 5). These promising genotypes produced 13.78 to 24.45% higher grain yield compared to the grain yield of the standard check, WK 1204.

Total 30 genotypes of wheat were included in the MPYT carried out during the year 2013. Amongst the tested entries, WK 2272 recorded the highest grain yield (6080 kg/ha) followed by WK 2274 (5152 kg/ha), WK 2278 (4480 kg/ha) and WK 2414 (4222 kg/ha). Statistically, the difference in heading days, maturity days, plant height, spikes/m², grain/spike and grain yield were found significantly different (Table 6). These high yielding genotypes produced 13.80 to 63.88% higher grain yield compared to standard check, WK 1204.

**Table 5: Grain yield and other ancillary characters of wheat in AVT during 2013**

| SN | Genotypes | Heading days | Maturity days | Plant height (cm) | Spikes/m² | Grains/spike | Grain yield (kg/ha) |
|----|------------|--------------|---------------|------------------|-----------|--------------|---------------------|
| 1  | WK 1118    | 114.67       | 149           | 105.97           | 62.33     | 47.17        | 2724                |
| 2  | WK 1792    | 113          | 147           | 105.4            | 55.9      | 38.86        | 2512                |
| 3  | WK 2407    | 111.67       | 145           | 93.23            | 59.63     | 28.67        | 2702                |
| 4  | WK 2408    | 111          | 147.67        | 102.07           | 70.63     | 39.28        | 4007                |
| 5  | WK 1204    | 111          | 148.67        | 101.9            | 65.8      | 47           | 3541                |
| 6  | WK 2409    | 108.67       | 147.33        | 105.83           | 54.3      | 48.73        | 3626                |
| 7  | WK 2410    | 111.67       | 149           | 109.13           | 61.23     | 41.3         | 3350                |
| 8  | WK 2411    | 103          | 144.67        | 100.57           | 66.53     | 43.37        | 4329                |
| 9  | WK2412     | 108.33       | 146.33        | 94.2             | 84.23     | 31.5         | 4407                |
| 10 | Munal-1    | 108.67       | 147.67        | 103.13           | 68.13     | 36.4         | 4054                |
| 11 | WK 1153    | 98.33        | 143.67        | 128.13           | 72.13     | 32.33        | 3237                |
| 12 | WK 2148    | 114.33       | 147           | 181.8            | 56        | 43.4         | 2450                |
| 13 | WK 2152    | 101.33       | 146.33        | 129.63           | 67.8      | 34.27        | 3316                |
| 14 | WK 2183    | 109.33       | 145.33        | 102.33           | 59.97     | 39.37        | 2948                |
| 15 | Chyakhura-1| 106.33       | 146.67        | 108.73           | 62.97     | 42.17        | 3993                |
| 16 | WK 2123    | 109          | 147.33        | 95.83            | 76.73     | 39.43        | 4002                |
| 17 | Chewink-1  | 108.33       | 148           | 102.13           | 66.03     | 42.77        | 3871                |
| 18 | WK 2128    | 114.33       | 150.33        | 110.07           | 68.13     | 40.03        | 3912                |
| 19 | WK 2180    | 108.33       | 149.33        | 105.9            | 55.73     | 47.2         | 3797                |
| 20 | WK 1481    | 104.67       | 147           | 147.7            | 49.63     | 42.3         | 3199                |

**Table 6: Grain yield and other ancillary characters of wheat in MPYT during 2013**

| SN | Genotypes | Heading days | Maturity days | Plant height (cm) | Spikes/m² | Grains/spike | Grain yield (kg/ha) |
|----|------------|--------------|---------------|------------------|-----------|--------------|---------------------|
| 1  | WK 2208    | 108          | 138.5         | 132.35           | 88.85     | 33           | 3375                |
| 2  | WK 2216    | 105.5        | 137           | 138.1            | 69.35     | 38.6         | 3625                |
| 3  | WK 2244    | 101.5        | 129.5         | 138.35           | 58.63     | 47.7         | 3483                |
| 4  | WK 2245    | 127          | 153           | 118.6            | 76.35     | 33.35        | 3057                |
| 5  | WK 2246    | 103.5        | 139           | 130.6            | 70.35     | 43           | 3325                |
| 6  | WK 2248    | 103.5        | 137           | 128.35           | 62.85     | 45.5         | 3470                |
| 7  | WK 2284    | 109          | 143.5         | 139.35           | 60.35     | 47.8         | 3801                |
| 8  | WK2254     | 106.5        | 140.5         | 120.25           | 71.75     | 31.5         | 3012                |
| 9  | WK 2259    | 106.5        | 129.5         | 94.6             | 62.85     | 28.55        | 2190                |
| 10 | WK 1204    | 102          | 133.5         | 100.45           | 58.75     | 42.15        | 3710                |
| 11 | WK 2261    | 106.5        | 135           | 119.45           | 67.95     | 39.9         | 3027                |
| 12 | WK 2272    | 105          | 141           | 108.1            | 76.1      | 44.6         | 6080                |
| 13 | WK 2273    | 108          | 134           | 96.85            | 72.25     | 29.5         | 2677                |
| 14 | WK 2274    | 111          | 145.5         | 103.85           | 90.6      | 37.1         | 5152                |
| 15 | WK 2278    | 109          | 145           | 138              | 88.1      | 38.85        | 4480                |
| 16 | WK 2290    | 102.5        | 137           | 82.25            | 41.35     | 55.85        | 3155                |
| 17 | WK 2291    | 102.5        | 134.5         | 103.85           | 65.85     | 40.9         | 3807                |
| 18 | WK2293     | 126.5        | 156           | 109.75           | 49.35     | 54.65        | 2547                |
| 19 | WK 2294    | 110          | 146.5         | 128.25           | 50.45     | 39.2         | 2670                |
| 20 | Munal-1    | 110          | 144.5         | 89.35            | 61.75     | 36.7         | 3356                |
| 21 | WK 2296    | 113.5        | 147           | 103.35           | 69.35     | 58.65        | 3307                |


**Conclusion**

The wheat genotypes namely NL1097, NL 1140 and NL 1093 were found promising genotypes for river basin agro-environment (546 meter above sea level) of far western hills. These promising genotypes were similar to standard check variety Gautam and Bhriuti in their maturity and grain yield. So, these promising genotypes need to be tested more in regional varietal trials of far western hills before they are recommended for those regions.

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