The present research study evaluate and identify the most suitable and high yielding genotypes of *Lens culinaris* for the salt marsh habitat of Swat in moist temperate sort of agro climatic environment of Pakistan. A total of fourteen genotypes were cultivated and analyzed through Randomized Complete Block Design (RCBD). These genotypes were AZRC-4, NL-2, NL4, NL-5, NL-6, NARC-11-1, NARC-11-2, NARC-11-3, NARC-11-4, 09503, 09505, 09506, P.Masoor-09 and Markaz-09. Different parameters i.e., germination rate, flowering, physiological maturity, plant height, biological grain yield, seed weight, pods formation and its height, pods per plants and protein content were focused specially throughout the study. Preliminary the Lentil genotypes have significant variability in all the major morpho-agronomic traits. The days to germination, 50% flowering and 100 seed weight ranged from 7 to 9, 110 to 116 days, and from 5.4 to 7.3 gm respectively. Biological yield and grain yield ranged from 5333 to 9777 kg ha$^{-1}$ and 1933 to 3655 kg ha$^{-1}$ respectively. Whereas, protein contents ranged from 23.21% to 28.45%. It was concluded that the genotype AZRC-4 is better varity in terms of grain yield plus in 100 seed weight and moreover, 09506 genotype was significant under salt marsh habitat in early maturing for the Swat Valley, Pakistan.
through development and adaptation of suitable agronomic management practices (Sadiq et al., 2001). It requires nitrogen in less quantity as compared to non-legume crops but phosphorus and potassium were essential nutrients for its higher and quality yield. Furthermore, lentil crop is grown to improve soil fertility by fixing atmospheric nitrogen through bacterial symbiosis (Mahmood et al., 2010). The factor that effect the yields of lentil were delayed maturity, lowered harvest index, disease infestation and frost damage (Whitehead et al., 2000). Lentil maturity is initiated by leaf senescence like other annual crops, which were triggered by plant hormones, drought and insufficient supply of nutrients especially Nitrogen (Conley et al., 2009). Because soil water availability and sites of soil Nitrogen mineralization were not controlled in dryland agriculture, soil nitrogen management and desiccant applications were the practical strategies to induce maturity in undefined crops (Gan et al., 2009; Menalled, 2015). Extensive vegetative growth, lodging and pod abortion due to limited light interception in the lower part of the canopy, excessive flower, pod shedding, competition between pods and vegetative parts for photosynthesis were all the consequences of indeterminacy and late maturity. Improved cultivars contributed to increase lentil production in yield. In most lentil production regions yield resulted to be no more than one half of the potential cultivar yield and far below theoretical mix yield. This difference reflects a production constraint that prevents the realization of true genetic yield potential (Sabaghnia et al., 2008).

The present study is conducted to evaluate the morphological and biochemical traits of various lentil genotypes seed types to grain yield. In most lentil production regions yield resulted to be no more than one half of the potential cultivar yield and far below theoretical mix yield. This difference reflects a production constraint that prevents the realization of true genetic yield potential (Sabaghnia et al., 2008).

3. Results

A total of fourteen genotypes were studied to evaluate the most suitable high yielding genotypes of Lens culinaris for agro climatic environment under salt marsh habitat of Swat, Pakistan. These genotypes were AZRC-4, NL-2, NL4, NL-5, NL-6, NARC-11-1, NARC-11-2, NARC-11-3, NARC-11-4, 09503, 09505, 09506, P. Masoor-09 and Markaz-09. The results obtained during research work, summarized and parameter-wise details are presented as:

3.1. Days to germination

The total 14 genotypes of lentil for various yields related to morpho-agronomic traits were studied. Initially data regarding number of days to germination (seedlings) was statistically significant. Maximum days to 50% germination were observed in genotypes NL-2, NARC-11-1 and 09503, whereas minimum numbers of days were observed in all remaining genotypes (Fig. 1).

3.2. Days to physiological maturity

The days to physiological maturity were extensively affected by many lentil genotypes. The recorded time for physiological maturity were ranged from 149–169 days. Among the tested genotypes, three genotypes i.e., 09506, Markaz-09, 09505 and P. Masoor were observed early matured availing 149, 150 and 150 days respectively. The lentil genotypes AZRC-4, NL-4 and NL-6 show late maturity taking 169 days correspondingly (Fig. 2).

3.3. Days to 50% flowering

The days to 50% flowering among the tested lentil genotypes ranged from 110 to 116 days. Maximum number of days to 50% flowering (116.33) were taken by genotypes NARC-11-1 followed by genotypes NARC-11-2 (116), while minimum days to 50% flowering (110) were recorded in genotypes NL_6 respectively (Fig. 3).

3.4. Days to pods formation

The present research work showed that the pods formation was significantly affecting among lentil genotypes. The maximum days for pods formation were observed in genotype NARC-11-2 followed by genotype NL-2 whereas minimum days were recorded in genotype Markaz-09 (Fig. 4).

3.5. No of pods per plant

The significant variations in number of pods per plants were investigated in various genotypes i.e., genotype AZRC-4 produces highest number of pods (123 per plant), which is followed by NL-2 that producing 104 pods per plant. Poor performance was shown in the genotype NARC-11-4 and NARC-11-1 respectively (Fig. 5).
Fig. 1. Number of days to germination of 14 various lentil genotypes in Swat, Pakistan.

Fig. 2. Days to Physiological maturity of various lentil genotypes in study area.

Fig. 3. Days to 50% flowering of various Lens culinaris genotypes.
3.6. Lowest pod height from ground level

In the genotype AZRC-4 maximum height of the lowest pod were observed, which is 2.97cm from the ground level, followed by NL-5 having 2.23cm height of the lowest pod. While minimum height of the lowest pod (0.793) was obtained in the genotype NL-2 (Fig. 6).

3.7. Biological yield (kg ha$^{-1}$)

Regarding biological yield, the genotype 09503 produces maximum yield up to 9777 kg ha$^{-1}$ which is followed by genotypes Markaz-09 having 9555 kg ha$^{-1}$, while the genotype NL-2 have minimum biological yield up to 5333 kg ha$^{-1}$ (Fig. 7).

3.8. Grain yield (kg ha$^{-1}$)

The grain yield data revealed significant effect of lentil genotypes. The maximum grain yield was recorded from genotypes AZRC-4 up to 3655.6 kg ha$^{-1}$, followed by genotypes 09506 with 3455.6 kg ha$^{-1}$ production. The P.Masoor-09 was the deprived genotype among all regarding the grain yield having 1933.3 kg ha$^{-1}$ production (Fig. 8).

3.9. Weight of 100 seeds

The 100 seed weight in various lentil genotypes ranging from 5.4 to 7.3 g. The genotype AZRC-4 was the heaviest seed with 7.3 g/100 seeds weight, followed by 09503 recording 7.1 g/100 seeds while genotype markaz-09 show lowest seed weight with 5.4 gm per 100 seeds weight (Fig. 9).

3.10. Protein content

The statistical analysis of protein content shows that the genotype Markaz-09, containing maximum amount of protein (28.45%), followed by genotypes NL-2 (28.24%). Whereas genotype NL-5 shows minimum amount of protein contents (23.21%) (Fig. 10).
Fig. 6. Height of the lowest pod from ground surface.

Fig. 7. Biological yield (kg/ha) of lentil genotypes in study area.

Fig. 8. Average values of grains yield of different lentil genotypes.
4. Discussion

The preliminary results of present study show maximum number of days (7) were recorded for genotypes NL-2, NARC-11-1 and 09503, whereas minimum number of days (6) to 50% germination were recorded for all the remaining genotypes. Similarly (Talaka et al., 2013) also reported considerable variation in days to 50% germination in concerning lentil genotypes. Regarding to 50 percent flowering day’s data ranged from 110 to 116 days. The maximum numbers of days (116.33) were shown by genotypes NARC-11-1 and minimum number (110) by genotypes NL-6. Like our findings (Wang et al., 2010) also reported the appropriate thing of flowering is a pivotal adaptive quality of controlling the circulation and survival of a plant species. Significant genetic variability in flowering period of lentil genotypes has also been reported by some earlier scientist like (Rakhsh et al., 1993; Ayub et al., 2001; Bicer and Şakar, 2004; Yaqoob et al., 2005a, 2005b).

It is cleared from the data that noteworthy difference exists among lentil genotypes regarding biological yield. Maximum biological yield (9777 kg ha\(^{-1}\)) were produced by genotypes 09503 followed by Markaz-09 (9555 kg ha\(^{-1}\)) while minimum (5333 kg ha\(^{-1}\)) was obtained from genotype NL-2. Overall biomass production was considered for economically important performance of a crop plant. On sun dried growth basis biological yield is measured as a result of ecological condition and nutrient uptake by the plants. The difference of yield was due to genetic variation among the genotypes studied. (Tyagi and Khan, 2010) concluded that pods per plant are the most important character which are responsible for treatment of seed yield in lentil.

The genotypes AZRC-4 revealed highest grain yield (3655.6 kg/ha) followed by genotypes 09506 (3455.6 kg ha\(^{-1}\)). Whereas minimum grain yields was obtained from genotype P.Masoor-09. It is also resulted that grain yield is affected by many agronomic condition and environmental factors. It depends upon on single yield components. Our result are same as result of (Ayub et al., 2001; Mandal and Majumdar, 2001; Reddy and Ahlawat, 2001; Bicer and Şakar, 2004; Yaqoob et al., 2005a, 2005b; Tyagi and Khan, 2010; Dutamo et al., 2015) who investigated that differences in the seed yield ha\(^{-1}\) due to change in genetic material.

In current study 100 seed weight in various lentil genotypes were significantly affected and rang from 5.4 to 7.3 g. The heaviest seed 7.3 g per 100 grain were produced by genotype AZRC-4 followed by 09503 7.1 g, whereas the lowest weight were reported from genotype markaz-09 5.4 g. For the final crop yield, seed
weight is essential factor for determination. The difference of seed weight of genotypes under observation was take place due to different genetic potential of genotypes for character. Size and weight of seed is important feature which directly correlates with final grain yield. The selection criterion on the basis of seed size varies different genetic potential of genotypes for character. Size and weight is essential factor for determination. The difference of seed weight and larger seed size do not need to produce more yield.

The Markaz-09 has more amount of protein contents in their seed (28.45%) followed by genotypes NL-2 (28.24%), while low protein contents were observed from genotype NL-5 (23.21%) respectively. Varieties have significantly different protein contents that are highest protein content in BARI Masur-4 (25.80%), BARI Masur-3 (25.50%), BARI Masur-2 (28.31%). According to (Khatun et al., 2010) they also concluded that seed present on lower plant parts had greater protein content as compare to middle and upper part of plant.

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