REVIEW OF LITERATURE
The main objective of the present investigation was the physiological analysis of groundnut genotypes differing in their genetic constitution in relation to growth and yield components. The secondary objective of the study was to find out the suitable traits for obtaining higher pod and oil yield during summer season. The third and most important objective was to study the source-sink relationship in groundnut cultivars.

The Green Revolution has brought self-sufficiency in food production in India but the nutritional security continues to be a serious concern. Edible oil is considered to be of prime importance among the important elements of nutritional security. In the last three decades there has been a significant increase in oil seed production as result the availability of edible oil has increased. This has been possible mainly through enhancement of production of oilseed indigenously.

In the last two and half decades, extensive research has been done for improvement of oilseed crops including groundnut. This has lead to development of a number of improved varieties and technologies related to crop production, crop protection and other areas related to cropping system. A good progress has also been made in basic and strategic research for development of technologies related to groundnut production. A good beginning has also been made for introgression of new germplasm for widening the genetic base of groundnut varieties.
Upto 1960s, the groundnut in India was grown only in rainy season (Kharif), but from 1971-72 its cultivation started in winter (Rabi) and summer also in A.P. Karnataka and Tamilnadu where it showed higher yield potential than Kharif. In Gujarat the Rabi/summer groundnut was introduced in 1977-78, Maharasstra in 1978-79 and in Uttar Pradesh from summer season of 2001.

A brief review of the past researchers has been given on this aspect in groundnut crop under appropriate heads.

2.1 Brief history of summer groundnut cultivation in U.P.:

The northern belt of alluvial soil of Uttar Pradesh having loamy sand, sandy loam and light loam texture is ideal for groundnut cultivation in rainy season. In the early 1980s groundnut was grown in Uttar Pradesh on 0.3 million ha with a production of 0.19 million tonnes. Since then both area and production have shown a steady decline. In 2002-03, the groundnut area was reduced to 0.09 million ha with a total production of 0.06 million tonnes and an average productivity of 660 kg/ha. Efforts to arrest this decline in area and production did not succeed due to various biotic and economic reasons. A strong need was felt to develop a suitable technology for groundnut cultivation under water limited conditions to revive groundnut in the state. Since the main function of the National Agricultural Research Project, Mainpuri is to lead the groundnut research, the scientific team of the project started work on summer groundnut in Uttar Pradesh. International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru, A.P. India, supplied 29 improved groundnut genotypes for evaluation during
summer season in 1998. Genotypes ICGV 93468 and Dh 86 gave very good performance during summer season and at initial stage both cultivars gave more than 2.0 t/ha pod yield after 85-90 days of planting. Varieties ICGV 93468 (Avtar) and Dh 86 were considered safe for farmers. At present both varieties are equally responding on farmers fields with yield level of 3.0 to 3.5 t/ha. This was the first unprecedental success for dissemination and diffusion of groundnut during summer season of Uttar Pradesh. Thus, the area under summer groundnut cultivation increased from scratch in 2001 to 3,61,066 ha with productivity of 27.10 q/ha. (Source: NRCG Newsletter and Jayad Phaslon Kee Saghan Padatiyan, 2013 of Department of Agriculture, U.P.).

2.2 Variations in growth and physiological parameters of different genotypes of groundnut:

Saini and Tripathi (1973) tried spreading and erect varieties of groundnut and found significant variation in plant height and number of branches/plant which was recorded higher in spreading than erect types.

Tomar et al. (1983) tried different varieties of groundnut at Rewa, Madhya Pradesh and found significant variation in plant height and branches/plant. Those were observed significantly higher in variety Gangapuri than others.

Reddy and Giri (1989) tried two varieties M13 and Kadiri 3 at New Delhi and observed that leaf area index and root biomass were significantly higher in M13 than Kadiri 3, while dry matter per plant was found not significant.
Tomar et al. (1990) reported from Rewa, Madhya Pradesh that groundnut variety Gangapuri attained higher values of plant height, branches/plant and dry weight/plant than the variety Jyoti tested in their study.

Das and Mishra (1991) tried five groundnut genotypes at Kalyani West Bengal and observed significant variations in branches/plant and total dry weight. Dry matter production ranged from 6.10 t/ha in ICGV 86055 to 9.93 t/ha in ICGV 86124 genotype.

Ahmed (1992) tried six improved genotypes of groundnut at Sonitpur, Assam. He reported that genotypes differed significantly in respect of plant height and number of branches/plant. Varieties ICGS 1, ICGS 5, ICGS 11 and ICGS 44 were reported superior to others in respect of branch formation.

Mishra (1994) studied the performance of three groundnut genotypes at Khargone, Madhya Pradesh. He observed significantly highest plant height in Gangapuri, while branches/plant were maximum in JL 24 genotype. Variety AK 12-24 remained in between in respect to both height and branches.

Patra et al. (1995a) tried 12 improved groundnut genotypes at Mohanpur, West Bengal. They reported that varieties varied in plant height, dry matter accumulation and leaf area index. Plant height was highest in ICGV 86149 while ICGS 44 and JL 24 recorded higher dry matter/plant and leaf area index than other tested varieties. The varieties did not vary significantly in net assimilation rate during 50-70 DAS.
Patra et al. (1996) tested two varieties (JL 24 and ICGV 86015) of groundnut and found significant variation in LAI at 70 DAS, dry matter production (g/m²) at 70, 90 and 110 DAS and NAR between 50-70 and 70-90 DAS. Variety JL 24 recorded higher values of growth characters than ICGV 86015 except NAR between 70-90 DAS, which was significantly higher in ICGV 86015 variety.

Reddy et al. (1999) tried five groundnut genotypes at Tirupati, India and reported significant variation in root length density and total dry matter production.

Singh (2004) reported from Regional Research station, Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur. The genotype ICGV 93468 produced shortest plant height and highest branches/plant over all the test genotypes and local check G 201 (Kaushal).

Upadhyay et al. (2005) tried five varieties of groundnut and observed higher plant height and number of branches per plant in ICGV 96469 compared with ICGV 96468, ICGV 96466 and two check varieties.

Ramesh et al. (2006) tested four cultivars of groundnut at Rajendra Nagar, Andhra Pradesh during rabi season. They reported that growth characters viz., plant height, total dry matter production, leaf area index and leaf area ratio were higher with K-134 compared to TMV-2 and ICG-24 genotypes.

Singh et al. (2007) evaluated thirty six genotypes of groundnut at Kalasila, Mizoram. They observed significant variation in plant height of
genotypes which varied from lowest of 30cm in TG 7 to the height of 67.7 cm in TMV 2.

_Jagtap et al. (2009)_ reported that the tested varieties of groundnut viz., J-17, I-09, T-18, I-13, J-30, I-43, ICGS-76, I-10, T-41 and I-3 did not show the significant response in RGR at 30-60 DAS, 60-90 DAS and 90 DAS till harvesting. The NAR was found significant at crop growth stages of 30-60 DAS and 60-90 DAS, but noted in significant at 90 DAS till harvesting stage of crop growth.

2.3 Variations in yield traits and yield of different genotypes of groundnut:

_Ali and Rawat (1982)_ tested four genotypes of groundnut at Jhansi, U.P. and found that all improved genotypes exotic L-1, SB 11 and Jyoti gave higher pod yield than local.

_Sisodia (1982)_ tried groundnut varieties at Akola, Maharashtra during summer season and observed that variety UF 70103 recorded 4% higher pod yield than variety SB XI.

_Tomar et al. (1983)_ reported from Morena, Madhya Pradesh that the variety Gangapuri gave significantly higher pod yield over cultivar Jyoti.

_Aegasimani et al. (1984)_ conducted an experiment on three varieties of groundnut at Dharwad, Karnataka. They reported that variety Dh 3-30 recorded highest pods/plant, shelling per cent and pod yield followed by M 13.
Kalra et al. (1984) tested five cultivars of groundnut at Dapoli, Maharashtra, during summer season for three continuous years. They reported that varieties Shulamith, M13 and SB11 yielded pods at par, but significantly higher over TG1 and Kopergaon 1.

Reddy and Shah (1984) tried four cultivars of both bunch and runner type at Anand, Gujarat. They reported differences in number of pods/plant, 100-kernel weight, shelling percentage and pod yield between varieties of both types. Chauhan et al. (1987) also reported significant variations in yield attributes and pod yield of groundnut varieties.

Reddy and Giri (1989) tried two cultivars of groundnut at New Delhi and observed significantly higher pods/plant, pod weight/plant and pod yield/ha in cultivar Kadiri 3 than M13 but 100-kernel weight and haulm yield were higher in M13 than Kadiri 3.

Tomar et al. (1990) reported from JNKVV, College of Agriculture, Rewa (M.P.) that variety Gangapuri produced significantly higher pod weight/plant, 100-kernel weight and pod yield (q/ha) than Jyoti. However, shelling per cent in Jyoti was slightly better than Gangapuri.

Kumpawat et al. (1991) studied the performance of three groundnut genotypes at Bhilwara, Rajasthan. They observed no significant variation in pod yield of AK12-24, TG-17 and JL24, but pods/plant were recorded lesser in JL24 variety.
Das and Mishra (1991) tested five genotypes of groundnut during summer seasons at Kalyani, West Bengal. They observed significant variation in pods/plant, 100-seed weight and pod yield. Pod yield was recorded highest in ICGV 86124 and lowest in ICGV 86055.

Rao et al. (1991) reported from Cuttack, Orissa that among the sixteen groundnut cultivars, NPG 22-Sel-4-1 gave highest pod yield over other genotypes. The harvest index was highest in J-30 (41%) followed by J-29 (37%). Pod yield q/ha showed highly significant positive correlation with pod yield/plant and harvest index.

Ahmed (1992) reported from Sonitpur, Assam that the groundnut varieties differed significantly in respect of plant height, pods/plant and pod yield. The highest yield was recorded in ICGS 1 (16.28 q/ha), which was on a par with the pod yield obtained from ICGS 5. The order of varietal performance was ICGS 1 > ICGS 5 > ICGS 11 > ICG (FDRS) 10 > ICG (FDRS) 4 > ICGS 44. The varieties viz., ICGS 1, ICGS 5, ICGS 11 and ICGS 44 utilized the sunlight effectively, as they are well branched, having small leaflets, dark green colour, which are evenly and sparsely distributed. These characters allowed the sunshine to enter into canopy. This supports the results of higher yield during summer by these varieties except ICGS 44.

Jadhao et al. (1992) carried out studies with two varieties of groundnut during summer season for three continuous years at Akola, Maharashtra. They reported that variety UF 70103 attained significantly higher values of pods/plant, pod weight/plant, 100-kernel weight, pod yield and haulm yield compared to SB XI variety.
Bhalerao et al. (1993) tried four groundnut cultivars during summer at Akola, Maharashtra and reported that cultivar Sel. 7-9-5, ICGV 87189, ICGV 86309 and J-19 gave dry pod yields of 2.61, 2.53, 2.10 and 1.86 t/ha, respectively. The significant variations were noted in plant height/plant, pod weight/plant, 100-pod weight, 100-kernel weight and haulm yield, but insignificant variation recorded in pods/plant among the tested genotypes.

Guggari et al. (1994) tried three groundnut cultivars during summer at Raichur, Karnataka and found that R 8808 gave the highest pod yield (2.43 t/ha) and KRG 1 produced lowest pods (1.82 t/ha).

Samui et al. (1994) reported from Nadia, West Bengal that cultivars ICGV 86015, ICGS 44 and JL 24 gave pod yields of 1.98, 2.79 and 2.00 t/ha, respectively, during summer season.

Mishra (1994) compared groundnut varieties JL 24, AK 12-24 and Gangapuri under rainfed condition. He observed that pods/plant, shelling percent, 100-kernel weight and pod yield (q/ha) were significantly highest in JL 24 and lowest in Gangapuri genotype.

Patra et al. (1995a) conducted the experiment on 12 genotypes of groundnut under rainfed condition at Mohanpur, West Bengal. The results revealed that genotypes varied significantly in respect to yield and yield attributes viz., pod/plant, kernels/pod, shelling percentage and 100-kernel weight and pod yield/ha. Genotype ICGS 44 out yielded all others, but JL 24 and TG 24 also gave pod yield at par with ICGS 44. These yields were attributed to higher values of pods/plant, kernels/pod, shelling percentage and 100-kernel weight in these genotypes.
In an other study, Patra et al. (1995 b) tried 10 varieties of Spanish bunch groundnut during kharif, rabi and summer seasons. The difference between varieties was significant for shelling per cent, kernel per cent, 100-kernel weight and pod yield. Varieties Kisan, Jawan, Girnar 1 and OG 52-1 were superior to others. In general, ICGS 11 was found stable than others.

Samui and Ahasan (1995) tried 15 genotypes and found that the ICGS 44 gave highest pod yield (q/ha).

Patra et al. (1996) reported from Mohanpur, West Bengal that significantly higher pods/plant, shelling per cent, 100-kernel weight, pod yield and haulm yield were found in JL 24 over ICGV 86015, while harvest index was at par in both cultivars.

Girdhar and Giri (1997) reported from New Delhi that Spanish type cultivar ICGS 1 produced 93% higher pod yield than Valencia bunch type MH 2 during summer season.

Bandopadhyay and Samui (2000) stated that cultivar JL 24 recorded higher values of yield attributing characters except 100-kernel weight. The 100-kernel weight was maximum with TG 19A. The pods/plant and shelling out turn were at par with those of JL 24 and TG 19A. The values of yield components recorded in TG 19A and JL 24 were significantly superior to the respective values of other varieties. TG 19A emerged to be the highest producer of pod yield and kernel yield followed by JL 24.

Deshmukh et al. (2003) compared three groundnut varieties at Rahuri, Maharashtra during summer season. They reported that variety TAG 24
significantly increased the pod yield/ha over SB XI and Konkan Gaurav. The variety TAG 24 produced 30.89q/ha pods, while SB XI and Konkan Gaurav produced 28.10 and 24.36 q/ha pods, respectively.

Datke et al. (2003) reported from Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, India that the genotype AK-205 gave highest average pod yield (17.95 q/ha), followed by AK-237 (17.21 q/ha) and AK-135 (17.14 q/ha) over genotypes AK-107, AK-143, AK-159, AK-240, AK-247, TAG-24 and TG-26 under average environments. Under unfavorable environments the highest pod yields were recorded for AK-240 (15.40 q/ha) and AK-159 (15.80 q/ha).

Kale et al. (2004a) stated that during rainy season of 2000-02, under All India Coordinated Research Project, Groundnut trails in Zone-I, TG 37A gave mean pod yield of 19.63 q/ha and seed yield of 12.46 q/ha with superiority of 26% and 40%, respectively, over the best check ICGV 86590. In these trails TG 37A had average maturity duration of 114 days, 64% shelling out turn and 39 gram 100-seed mass. It showed 1.5% incidence of collar rot as against 20.4% in the test entry Dh 2000-1 and 6.7% incidence of BND as against 39.8% in the check variety JL 24.

During rainy season of 2000, 2001 and 2003 under AICRP-Groundnut trails in Zone II, TG 37A performed well with pod yield of 30.40 q/ha and seed yield of 21.73 q/ha, it showed an increase in pod yield 22% over ICGS 37 and 23% over JL 24, respectively. In these trails, TG 37A had an average maturity duration of 97 days, 71% shelling out turn and 45 gram 100-seed mass.
TG 37A continued its good performance in summer season also. In AICRP-Groundnut trails conducted during 2000, 2002 and 2003 in Zone IV of India, TG 37A had pod yield of 31.86 q/ha and seed yield of 22.31 q/ha with superiority of 19% and 20%, respectively, over the best check ICGS 44. In this Zone, TG 37A had an average maturity duration 122 day, 68% shelling out turn and 48 gram 100-seed mass.

Kale et al. (2004b) again reported from the BARC, Trombay, Mumbai, cultivar TPG 41 gave 39.00 q/ha pod yield and 26.40 q/ha seed yield with 20% and 23% superiority over the best check variety TKG 19A (32.60 q/ha pod yield and 21.50 q/ha seed yield), respectively. It matured in 115-120 days with a shelling out turn of 70% and 100-seed mass of 73 gram as compared to 67% shelling out turn and 66 gram 100-seed mass of the best check.

In All India Coordinated Research Project, Groundnut during summer season of 1998 - 1999 to 2000-01 and 2002-03, TPG 41 also produced a mean pod yield of 23.13 q/ha and seed yield 29% increase over B 95. It matured in 122 days with an average 100-seed mass of 65 gram and 69% shelling out turn.

Nagda and Joshi (2004) reported from MPUAT, Udaipur, Rajasthan that in All India Coordinated Varietals trials conducted at 10 locations, Pratap Mungphali 1 produced a mean dry pod yield of 24.50 q/ha as compared 19.07 q/ha of check JL 24, thereby, exhibiting 28.7% pod yield superiority over the latter. Pods were found two seeded with moderate reticulation, constriction and beak. Seeds were medium, spheroidal and pink in colour.
Bochalia and Kaushik (2004) found that the genotype TG 37A recorded the highest values of yield attributes viz., pods/plant and 100-seed weight followed by JL 24 and ICUG 92035. ICUG 92035 was on a par with JL 24. The highest pod yield (41.94 q/ha) and haulm yield (89.22 q/ha) were produced by TG 37A, which were significantly higher than those of ICUG 92035 (pod yield 35.70 q/ha and haulm yield 77.06 q/ha) and JL 24 (pod 36.94 q/ha and haulm yield 79.56 q/ha).

Upadhyay (2004) reported from ICRISAT, Patancheru, Andhra Pradesh that genotype ICGV 93437, an early maturing, high yielding variety performed well and was released in 1999 as Nyanda in Zimbabwe. ICGV 93437 has shown good adaptability to the drier environment in Zimbabwe. It is also capable of producing high yields in areas of moderate rainfall and under irrigation. In Zimbabwe, ICGV 93437 produced 13.5% more pod yield than the local control cultivar Falcon in 51 trials during 1996-97 to 2000-01. ICGV 93437 mature in 85-90 days after sowing, 10 days earlier than the popular early maturing cultivar JL 24 in rainy season at ICRISAT, Patancheru, A.P.

Sarawat et al. (2004) reported from Thailand that Khon Kaen 6 (cultivar developed in the association of ICRISAT, Patancheru, A.P.) yielded by 25.69 q/ha pod yield over control Khon Kaen 60-3 (11.69 q/ha). It matures 6 days earlier than Khon Kaen 60-3. The shelling out turn of this variety was 67.4% with 82.8 gram 100-seed mass and pink seed colour.

Sugui (2004) reported fromPhilippines that the variety NSIC Pn 12 developed in collaboration of ICRISAT, Patancheru, A.P. produced a mean
yield of 15.90 q/ha, 0.63% more than check variety NSIC Pn 6. In dry season, NSIC Pn 12 out yield NSIC Pn 6 by 3.44%. NSIC Pn 12 has an erect growth habit. It matures in 95-98 days during the rainy season and 96-98 days during dry season. The majority of the pods are two seeded with an acceptable shelling out turn of 71.72%. Pods have slight beak, moderate constriction and slight reticulation. The seeds are oblong and large with pink seed coat. The seed contains 26.26% crude protein, 40.18% crude fat, 11.37% carbohydrates and 2.19% ash.

At Oil Crops Research Institute of CAAS, Wuhan, Hubei, China, Boshou and Yong (2004) have developed a black seed coat groundnut Zhonghua 9 from hybrid progenies of a cross (5001 x NC AC 17133) x 5001 by pedigree method for the first time. Zhonghua 9 produced yield similar to the local control. It was regarded as a special edible groundnut cultivar because of its black seed coat, which many consumers liked.

Assar et al. (2004) reported from ElObeid Agricultural Research Station, ElObeid, Sudan that C 69A-25-1-1-1 (Tozi) and C 109A-7-4-B-2 (ElAhmedi) significantly out yielded the controls. C69A-25-1-1-1 showed increase in pod yield of 30% over Kiriz and 14% over MH 383 in ten trials and increase of 36%, 15% and 16% over Kiriz, MH 383 and Medani, respectively, in seven trials. C 109A-7-4-B-2 also showed increase in pod yield of 29% over Kiriz and 13% over MH 383 in ten trials and increase of 35%, 15% and 15% over Kiriz, MH 383 and Medani, respectively, in seven trials. C 69A-25-1-1-1 with 46 g average 100-seed mass belong to the Spanish
type, which is predominantly grown in the rainfed areas of Western Sudan, C 109A-7-4-B-2 with average 100-seed mass of 60g could be characterized as a Virginia market type. Both cultivars have reasonable high shelling out turn and high haulm yield.

A varietals trial of 12 improved genotypes and local check G 201 (Kaushal) was laid out during summer season at Regional Research Station, Mainpuri. The genotype ICGV 93468 gave higher pod yield (23.40 q/ha) as compared to other test genotypes and local check during summer season. Number of pods/plant, pod mass/plant, number of seeds/plant, seed mass/plant and 100-seed mass were also higher in ICGV 93468.

In other experiment conducted during rainy season on eight genotypes, genotype ICGV 93468 gave higher pod yield (22.50 q/ha) than the other test genotypes and local check G 201. These results indicated that ICGV 93468 performed equally well during both summer and rainy seasons (Singh, 2004).

Singh (2005) reported from C.S. Azad University of Agriculture and Technology, Kanpur that the genotypes ICGV 93468 and Dh 86 gave very good performance among all 29 test genotypes during summer season and both varieties equally responded with yield level of 3.5 t/ha. Due to high yield potential low incidence of insect, pest and diseases, better survival under moisture stress condition, early maturity and thermo tolerance, ICGV 93468 (Avtar) and Dh 86 were considered safe for farmers of Uttar Pradesh.

The adaptive trial was conducted on farmers fields of Tribal area, Nandurbar district during Kharif 2003 and 2004 and summer 2004 by Murty
and Kale (2005), Bhabha Atomic Research Centre, Trombay, Mumbai, Maharashtra. Cultivar TG 26 gave higher yield of 14.15 q/ha over local variety (10.95 q/ha). Similarly variety TAG 24 gave higher pod yield as 15.60 q/ha over local variety (10.30 q/h). During summer season, cultivar TG 26 gave higher yield by 22.70 q/ha over the local variety (10.10 q/ha).

Ramadevi and Ramarao (2005) compared JL 24 and TPT 4 genotypes of groundnut during rabi season at Tirupati, India. They reported that genotype JL 24 gave significantly higher pod yield than TPT 4.

Upadhyay et al. (2005) tried three improved genotypes having bold seed and early maturity viz., ICGV 96466, ICGV 96468 and ICGV 96469 against two control viz., JL 24 and Somnath at ICRISAT, Patancheru, Andhra Pradesh during rainy and post rainy seasons. They reported that all improved genotypes gave significantly higher pod yield than locals with greater 100-kernel weight. Among improved genotypes, ICGV 96469 proved highest yielder.

A varietals trial with improved varieties and a local check G 201 (Kaushal) was laid out during summer season of 2005 at RATDSs Hardoi, Mathura (at Raya) and Bareilly (at Belva). The genotype ICGV 93468 gave higher average pod yield (2.17 t/ha) compared to ICGS 1, ICGS 44, ICGV 86590 and G 201 (local check). ICGV 93468 gave 71.15% higher pod yield than local check G 201. The maximum yield of ICGV 93468 was 2.91 t/ha, harvested in Central Plain Zone of Uttar Pradesh at RATDS, Hardoi closely followed by 2.46 t/ha in South Western Semi-Arid Zone at RATDS, Mathura.
The minimum yield obtained was 1.13 t/ha in Middle Western Plain Zone at RATDS, Bareilly. The yield variation in ICGV 93468 was not due to agroclimatic zones of Uttar Pradesh but due to time of sowing. In Hardoi and Mathura sowing was done under recommended time, while at Bareilly it was planted one month late (Singh, 2006a).

Singh (2006b) reported that the cultivars Dh 86 (2.63 t/ha) and ICGV 93468 (2.61 t/ha) registered significantly higher pod yield during summer season. Cultivar G 201 gave lowest yield of 1.44 t/ha. Therefore, the order of varietals performance was Dh 86 and ICGV 93468, followed by ICGS 1, ICGS 44, ICGV 86590 and G 201 in summer season.

Singh (2006c) reported from C.S. Azad University of Agriculture and Technology, Kanpur that the groundnut cultivars Dh 86 and ICGV 93468 gave higher pod yield during summer season. Cultivar Dh 40 gave lowest yield. Therefore, the order of varietals performance was Dh 86 & ICGV 93468 > R 9251 > R 2000-1 > TG 37A > ICGS 1 > ICGS 44 > ICGV 86590 & R8808 > G 201 > Dh 40 during summer season after harvesting of mustard. The highest yield of Dh 86 and ICGV 93468 was due to its genetic potentiality.

An experiment was carried out by Singh (2006d) at Zonal Agricultural Research Station, Mainpuri to judge the efficacy of eight short duration genotypes of groundnut during both rainy and summer season under groundnut-wheat-summer groundnut cropping system. Cultivar ICGV 93468 produced significantly higher pod yield (22.49 q/ha) followed by Dh 86
(20.81 q/ha) during rainy season. Similarly variety Dh 86 proved better and gave 19.02 q/ha pod yield, which was highest and at par with yield level of ICGV 93468 (18.63 q/ha) during summer season.

The genotype Dh 86 produced significantly smallest plants, whereas, the main shoot height was maximum in ICGV 94357 cultivar. Pods/plant was significantly higher in ICGV 93468 and Dh 86 compared to other cultivars, while this difference in ICGV 94299, ICGV 96359, ICGV 95299 and ICGV 94357 was not significant.

The kernels/pod was not found significant, while 100-kernel weight was significantly highest in ICGV 93468 and Dh 86 because of its bolder kernel size. The lowest 100-kernel weight was observed in ICGV 94299, ICGV 96359, ICGV 95299 and ICGV 94357 due to its thinnest kernel size during rainy season. He further reported in respect of summer groundnut that the genotype Dh 86 emerged significantly smallest plants, while cv. ICGV 94357 produced tallest plants. The values of yield components recorded in term of pods/plant, kernels/pod and 100-kernel weight in Dh 86 and ICGV 93468 were significantly superior to the respective values of other test varieties.

Six groundnut cultivars were evaluated by Chuni Lal et al. (2006) at Junagadh, Gujarat. The cultivar B 95 registered highest pod yield, 100-pod weight and 100-kernel weight at all locations during different years compared to GG 2, JL 24, Somnath, ICGS 44 and Kadiri 3.
Chandra et al. (2006) tried seven cultivars of groundnut at Nadia, West Bengal and reported highest pod yield with ICGS 44 genotype. In the studies of Deshpande et al. (2006), groundnut genotype ICGV 92004 produced significantly higher pod yield than the genotypes ICGV 93128, ICGV 92267 and TAG 24, tested in the trial.

Ramesh et al. (2006) tried four genotypes of groundnut at Rajendra Nagar, Andhra Pradesh and found that genotype K134 gave significantly higher pod yield compared to TMV 2, TPT 2 and ICG 24.

Subrahmanian and Kalaiselven (2006) compared B 95 and GG 5 groundnut cultivars at Vridhachalam, Tamilnadu and found that pod yield did not vary significantly. Tiwari et al. (2006) studied the comparative performance of three groundnut varieties viz., Chitra, Amber and Kaushal (G 201) at Kanpur, Uttar Pradesh. They recorded highest pod yield with Amber followed by Chitra and Kaushal.

Singh et al. (2007) reported that the cultivars Dh 86 (1.85 t/ha) and ICGV 93468 (1.84 t/ha) produced significantly higher pod yield in summer season. The check cultivar JL 24 yielded 0.72 t/ha. Therefore, the order of performance of the cultivars was Dh 86 (1.85 t/ha) and ICGV 93468 (1.84 t/ha) > NRCG 2063 (0.79 t/ha) > NRCG 12082 (0.74 t/ha) > TG 26 (0.73 t/ha) > JL 24 (0.72 t/ha), B 95 (0.72 t/ha) and NRCG 7150 (0.72 t/ha). ICGV 93468 and Dh 86 are high yielding cultivars of groundnut and most suitable for cultivation during summer season.
Ranjit et al. (2007) reported from Dharwad, Karnataka that groundnut genotype Dh 86 gave significantly higher pod yield than GBPD 4 by a margin of 11.2 per cent, while GBPD 4 recorded significantly higher haulm yield than Dh 86 during summer season.

Chuni Lal et al. (2007) reported the results of advanced varietals trials. Among early maturing lines, ICGV 00321 gave the highest pod yield. In the trials of Spanish entries PBS 16033 gave highest pod yield followed by PBS 16031, PBS 11046 and PBS 16032, while the check GG2 gave lowest pod yield. In the preliminary yield trial of Virginia entries, highest pod yield was recorded in check GG 20 followed by PBS 24090. In advanced trial of Virginia entries PBS 26015 recorded highest pod yield followed by PBS 26014, while lowest was recorded in check Kaushal and GG 20.

Nautiyal et al. (2007) tried different genotypes during kharif as well as summer seasons at Junagadh, Gujarat. They reported that during kharif. JUG 16 gave significantly highest pod yield followed by JAK 42 and ICR 3, while during summer ICR 4 recorded significantly highest yield followed by TIR 17 and JUG 16 genotypes.

In the study of Singh et al. (2007) carried out at Kolasib in Mizoram with forty groundnut genotypes, M 13, ICGS 76 and TPG 41 gave higher yields by more than 2500 kg pods/ha. The three years of data indicated that the genotypes TKG 19A, GG 20, ICGS 76, ICGV 88448, JL 24, JL 220, CSMG 84-1, ICGV 86590 and M 13 were found higher yielder than others. Hence these genotypes were identified as suitable for Mizoram and adjoining
areas of NEH region. They further reported that among eight genotypes of confectionary groundnut, ICGS 76 and M 13 was found higher pod yielder than rest of the genotypes tested in Manipur and Mizoram, India.

*Chuni Lal et al. (2007)* evaluated fourteen breeding lines along with two check at Junagadh, Gujarat. Among the advanced breeding lines, significantly superior performance was recorded in ICGV 96342 for specific leaf area; ICGV 96352, ICGV 97257 and ICGV 97261 for shelling percentage; ICGV 97245 for 100-seed weight; ICGV 97262 for sound mature seeds and ICGV 96399 and ICGV 97245 for per day productivity. Only two advanced breeding lines i.e., ICGV 96399 and ICGV 97245 recorded numerically superior for pod and seed yields over check GG2.

*Rajagopal et al. (2007)* evaluated 120 released varieties of all the four habit groups during *kharif* season. They reported significant variations among varieties in respect to yield attributes and yield. Pods/plant varied from 3.43 to 17.13, 100-pod weight from 50.93 to 130.40 g, 100-seed weight from 22.13 to 57.87 g, shelling percent from 55.27 to 72.10 and pods weight/plant from 3.33 to 50.60 g. Among large seeded varieties, range of variability was observed from 51.07 to 71.57 in shelling percent, 24.00 to 55.93 g in 100-seed weight and pod weight/plant from 1.90 to 13.13 g.

*Hariprasanna et al. (2007)* reported the performance of seventeen selected genotypes of groundnut, tried in advanced yield trial. Genotype PBS 29082 gave highest pod yield followed by ICGV 89214, while lowest pod yield was recorded in PBS 29067. They recorded 100-seed weight highest in
PBS 29079 and lowest in GG 20 check. In international trial, recorded highest pod yield under ICGV 00440 and lowest in TPG 41 (check). The weight of 100-seed was also recorded highest in ICGV 00440 and lowest in check genotype TPG 41.

**Bera et al. (2007)** evaluated thirty three selected genotypes of groundnut along with three standard checks at KVK, Mundra, Gujarat for three continuous years. They observed highest pod yield in genotypes CS 170, CS 285 and check M 13, while lowest pod yield was recorded in CS 164 and CS 130 genotypes. Shelling per cent was recorded maximum in CS 188 closely followed by CS 268, while lowest in CS 249. The weight of 100-seed was found highest in CS 281 and lowest in CS 159 genotype.

**Singh (2008)** reported from C.S. Azad University of Agriculture and Technology, Kanpur that the genotypes Dh 86 and ICGV 93468 gave significantly higher pod yield during summer season in comparison to ICGS 1, ICGS 44, ICGV 86590 and G 201. Variety G 201 gave lowest yield compared to other test genotypes.

**Kabadagi et al. (2008)** reported from Regional Agricultural Research Station, UAS, Bijapur, Karnataka, India that the genotype R – 9251 recorded the significantly higher number of pods per plant, 100-pod weight, shelling percentage, 100-kernel weight, pod yield (q/ha) and kernel yield (q/ha) as compared to the genotype K-134 during summer season.

**Dhadge et al. (2008)** evaluated the performance of eight groundnut varieties during *rabi* season at Igatpuri, Maharashtra for two continuous
years. They reported that the variety ICGS 11 produced significantly higher dry pod, dry haulm and kernel yield than rest of the varieties. Higher shelling percentage was recorded in variety TG 26, while maximum 100-kernel weight and 100-pod weight were recorded in variety B 95.

Jagtap et al. (2009) reported from Mahatma Phule Krishi Vidyapeeth, Rahuri that the genotype J-30 (24.36 q/ha) recorded significantly highest pod yield per hectare over genotypes J-17, I-09, T-18, I-13, I-43, ICGS-76, I-10, T-41 and I-3. The genotypes J-17 (20.95 q/ha) I-13 (20.87 q/ha), I-09 (19.92 q/ha), ICGS-76 (19.60 q/ha) and T-18 (19.37 q/ha) were at par in pods yield with each other. The genotype I-10 (16.90 q/ha) recorded the significantly lowest dry pod yield per hectare as compared to other genotypes. The genotypes J-30 and J-17 performed better over I-09, T-18, I-13, I-43, ICGS-76, I-10, T-41 and I-3 genotypes of groundnut, studied in respect of pods/plant, pods weight/plant, kernels weight/plant, kernels/plant, 100-kernel weight and harvest index.

Singh (2010) reported that the genotype ICGV 99195 registered significantly higher pod yield (2.35 t/ha) compared with all the test varieties except ICGV 00298 (2.30 t/ha). Local check (G 201) reduced pod yield by a margin of 1.23 t/ha and 1.18 t/ha in comparison to ICGV 99195 and ICGV 00298, respectively, at Regional Research Station, Mainpuri. The order of performance of the cultivars at Regional Agricultural Testing and Demonstration Station, Hardoi was ICGV 99195 (1.66 t/ha), ICGV 02099 (1.58 t/ha), ICGV 00298 (1.57 t/ha), ICGV 00310 (1.55 t/ha), ICGV 02022
(1.51 t/ha), ICGV 94361 (1.25 t/ha) and Kaushal (1.04 t/ha). At Regional Agricultural Testing and Demonstration Station, Mathura, the highest pod yield of 1.63 t/ha was reaped from genotype ICGV 00298 compared with other test genotypes during summer season. Local check ICGS 44 gave pod yield of 1.33 t/ha. Therefore, the order of performance of the genotypes was ICGV 00298 (1.63 t/ha), ICGV 00310 (1.57 t/ha), ICGV 99195 (1.51 t/ha), ICGV 02099 (1.39 t/ha), ICGV 94361 (1.36 t/ha), ICGS 44 (1.33 t/ha) and ICGV 02022 (1.30 t/ha). The both high yielder varieties were found suitable under low fertility and moisture stress conditions and negligible losses under both optimum and late sown condition was seen.

Vaghasia et al. (2010) conducted an experiment at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh (Gujarat), India with six genotypes i.e., JBDR-5, JBDR-7, JBDR-64, ICGV-92121, GG-2 and GG-6 during summer season. They reported that the genotype GG-6 gave highest pods/plant, 100-kernel weight, pod yield (q/ha) and harvest index (%) over other tested genotypes but variation in shelling percent and haulm yield were not found significant.

Singh (2011) reported that the cultivars Dh 86 and ICGV 93468 gave pod yield by 2.77 t/ha and 2.75 t/ha, respectively, on riverine alluvial soils of Semi-Arid-Tropics area of Uttar Pradesh.
2.4 Variations in quality parameters of different genotypes of groundnut:

Reddy and Giri (1989) observed no significant difference in seed oil content of groundnut varieties M 13 and Kadiri 3, tested at New Delhi, India.

Jadhao et al. (1992) reported that the groundnut genotype SB XI contained slightly more oil in seed than UF 70103 in three years study at Akola Maharashtra.

Bhalerao et al. (1993) reported from Oilseeds Research Unit, Punjabrao Krishi Vidyapeeth, Akola, Maharashtra that the cultivar ICGV 87189 contained higher oil content in kernels (48.9%) over genotypes Sel. 7-9-5 (48.4%), ICGV 86309 (48.0%) and J-19 (46.7%).

Mishra (1994) evaluated seed oil content in three varieties of groundnut and found maximum seed oil (50.40%) in JL 24 followed by AK 12-24 (49.10%) and Gangapuri (47.80%).

Patra et al. (1995a) estimated oil content in kernel in 12 improved genotypes of groundnut produced during kharif season under rainfed condition. They observed highest oil content in kernel of 48.44% in ICGS 44 followed by JL 24 (48.05%), TG 24 (47.26%) and ICGV 86015 (47.16%). Lowest seed oil (43.93%) was estimated in genotype TG 19A. They reported highest oil yield (929 kg/ha) in ICGS 44 and lowest (549 kg/ha) in TG 19A genotype.

Patra et al. (1996) estimated oil content and oil yield in two varieties of groundnut and reported significantly higher values of both in variety JL 24 (49.10% and 857 kg/ha) than ICGV 86015 (47.50% and 753 kg/ha) in two years of investigation.
Bandopadhyay and Samui (2000) stated that TG 19A gave higher oil yield followed by JL 24. The oil content was higher in JL 24 and it was at par with TGS 1.

Kale et al. (2004a) stated that TG 37A gave 51% oil content in kernel, which was higher over the best check ICGV 86590 and test entry Dh 2000-1, during rainy season of 2000-02 in zone I.

They further reported that in Zone II, TG 37A gave 50% oil content in kernel, which was higher over the ICGS 37 and JL 24 during rainy season of 2000-2001 and 2003. During summer season of 2000-2002 and 2003 in Zone IV of India, TG 37A gave 53% oil content in kernels of groundnut, which was higher over best check ICGS 44.

Nagda and Joshi (2004) reported from MPUAT, Udaipur, Rajasthan that the oil content in Pratap Mungphali 1 (50.50%) was higher than that in JL 24 (48.60%).

Boshou and Yong (2004) reported that Zhonghua 9 cultivar of groundnut produced 49.30% oil content in kernel.

Assar et al. (2004) reported that the cultivars C69A-25-1-1-1 (Tozi) and C109 A-7-4-B-2 (ElAhmedi) gave higher oil content in kernel over Kiriz, MH 383 and Medani.

Upadhyay et al. (2005) compared three high yielding varieties of groundnut with respect to different plant and seed characters. They reported that genotypes ICGV 96469 and ICGV 96466 had more oil content in kernel
by 48.60% and 48.50%, respectively, than ICGV 96468, which contained 47.80% oil content in kernel.

**Tiwari et al. (2006)** estimated oil content in kernel in three genotypes of groundnut at Kanpur. They reported that oil percentage in kernel was highest in Amber followed by Chitra and Kaushal.

In the study of **Ranjit et al. (2007)**, significantly higher oil yield was found in genotype Dh 86 (937.01 kg/ha) than GBPD 4 (857.32 kg/ha) during summer season at Dharwad, Karnataka.

**Kabadagi et al. (2008)** reported from R.A.R.S., UAS, Bijapur, Karnataka, India that cultivar R-9251 recorded significantly higher oil content in kernels (47.72%) and oil yield (646.4 kg/ha) over K-134 during *rabi*/summer season.

**Vaghasia et al. (2010)** reported from Junagadh Agricultural University, Junagadh, Gujarat that the oil content (%) in kernels was not found significant but higher value of oil content (%) in kernels was noted in GG-6 as compared to JBDR-5, JBDR-7, JBDR-64, ICGV-92121 and GG-2.

### 2.5 Economic aspect of groundnut genotypes:

**Shaikh (1995)** worked out the economics of different genotypes of groundnut and found significant differences among the genotypes. The high yielder genotypes gave higher gross return and net profit.

**Patra et al. (1996)** estimated the economics of JL 24 and ICGV 86015 genotypes at Mohanpur, West Bengal. Genotype JL 24 gave significantly higher gross as well as net return than ICGV 86015.
Devi Dayal et al. (2003) reported from Junagadh, Gujarat that groundnut genotypes varied in monetary return. Cultivar GG 20 gave significantly higher gross return (25.20%) and net return (3.78%) with a greater B:C ratio of 3.76 than the local cultivar GAUG-10 at farmers fields. Other cultivars tested were GG 4, J 11, GG 13 and GG 2, which gave returns lesser than GG-20 cultivar.

Singh (2006 d) reported from C.S. Azad University of Agriculture and Technology, Kanpur that the cvs. ICGV 93468 and Dh 86 gave highest monetary return and benefit cost ratio in comparison to other test genotypes.

Vaghasia et al. (2010) tested six genotypes i.e., JBDR-5, JBDR-7, JBDR-64, ICGV 92121, GG-2 and GG-6 at Junagadh Agricultural University, Junagadh, Gujarat and they reported that genotype GG-6 gave highest net return of Rs 26247/ha and B:C ratio of 2.16 over other tested genotypes during summer season.

All review mentioned above shows that groundnut genotypes varied significantly from each other in respect to growth characters, physiological parameters, yield attributes and yields. Suitability of groundnut genotypes varied under different agro-climatic and adaphic situations of experimentation. In general bunch type genotypes of groundnut performed better than runner types during summer season. A strong need was felt to carry out the research work on physiological studies on growth, development and productivity in summer groundnut genotypes for marking valuable and useful recommendation to the researchers, extension workers and farmers.