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^{1,2}Magadh University, Bodhgaya, (Bihar) INDIA**ABSTRACT**

*This paper describes the domestication of sunflowers (*Helianthus annuus* L.) by humans for particular structures that are desirable to humans in relatively generous environmental conditions and stresses have constrained these plants to experience evolutionary increases in the yield, yet at the cost of lessened guard mechanisms against biotic and a-biotic burdens and diseases. A large number of factors, for example, bugs and diseases diminish the sunflower yield, and research to create bother resistance, herbicide resistance, increasing oil per acre yield of sunflower holds indispensable. Wild types of sunflower contain rich wellspring of helpful qualities, which should be transferred to cultivated ones. In spite of the fact that enhanced transformed systems have been accounted for, more productive transformation convention should be investigated. There are a few reviews including transgenic sunflower plants to increase yield, oil content, bug/fungal resistance, stretch tolerance and generation of bio-pharmaceutical proteins.*

Key words: *Transgenic sunflower, transient expression, Stress resistance, Insect resistance, Oil yield, Bio-pharmacy*

1. INTRODUCTION

Sunflower (*Helianthus annuus* L. $2n=2x=34$) has a place with the class *Helianthus*, family 'Asteraceae', tribe 'Heliantheae', subtribe *Helianthinae*, which incorporates 20 genera with 67 species. On the planet it is cultivated on a territory of 23.83 mha with the generation of 32.16 mt. In India it positions fourth in range (1.48 mha) and creation (1.00 mt). In India, Karnataka took after by Andhra Pradesh, Maharashtra and Tamil Nadu are the customary sunflower developing states; Punjab, Haryana, West Bengal and Uttar Pradesh are promising spring sunflower developing states. In Karnataka, sunflower is developed in a range of 1.026 m.ha with yearly generation of 0.586 mt and efficiency of 571 kg/ha (Blackman *et al.*, 2011) [1]. The North Karnataka areas contribute a noteworthy share to sunflower generation in Karnataka. Among them, Bijapur positions

first in territory and creation took after by Raichur, Gulbarga, Bagalkot and Bellary.

Sunflower is the rich wellspring of eatable oil (40%~52%). Sunflower oil is considered as useful for wellbeing from the purpose of high centralization of PUFA (linoleic corrosive 55%~60% and oleic corrosive 25%~30%) which are known to lessen the danger of coronary maladies. Sunflower is one of the valuable unforeseen harvests particularly under reined development attributable to its day impartial nature and resistance to temperature and soil dampness administrations. Hereditary differing qualities at genotypic level is the pre essential for choice of assortments for plant rearing projects and the differences can be identified by a few means.

Actuated transformations have been connected for as long as 40 years to deliver

mutant cultivars in sunflower by changing plant attributes for noteworthy increment in plant efficiency. Mutagenic medicines, normally on seed, have actuated high-oleic, semi-diminutive people and midgets, male-clean plants and other intriguing variations, for example, earliness and seeds with thin structure (Chen and Welter, 2002) [2].

Cultivated sunflower (*Helianthus annuus* L.) has its starting point from North America and is one of only a handful little noteworthy nourishment edits on the planet (Harter et al., 2004) [3]. Taming of sunflowers by people for specific structures that are alluring to people in a moderately benevolent ecological conditions and stresses have constrained these plants to experience evolutionary increments in the yield, however at the cost of decreased protection instruments against biotic and a-biotic stresses and infections (Mayrose et al., 2011). Mayrose et al. (2011) [4] considered development attributes of sunflower under considerate natural condition which they observed to be more noteworthy for the tamed genotype populace than that for the wild populace, however with a drop in protection reaction in tamed sunflowers when presented to biotic and a-biotic stresses. Also, it was found that lepidopteron bugs favored tamed sunflowers more than the wild sunflowers in trial horticulture fields. It was likewise uncovered that *Botrytis cinereous* and dry season had more negative results on trained sunflowers than the local plants. A large number of variables, for example, creepy crawlies and infections diminish the sunflower yield, and sub-atomic science explore with an attention on transgenic sunflowers to create bug resistance, herbicide resistance, expanding oil per section of land yield of sunflower holds irreplaceable and in addition its review on natural effect is squeezing.

2. STUDIES OF GENETIC VARIABILITY OF SUNFLOWERS

Different methodologies underway of transgenic plants have been utilized, yet with low effectiveness in change: Polyethylene glycol (PEG)- instigated vector take-up of PCAMVNEO into protoplasm secluded from sunflower seedling hypocotyls (Moyne et al., 1988) [5].

PEG-incited vector take-up ended up being for the most part worked serious and some different conventions with Bacterium-intervened change of sunflower plants have been utilized (Knittel et al., 1994) [6]

One plausibility with regards to the explanation behind less review with stable change explores different avenues regarding sunflowers could be a result of no proficient and reproducible convention for sunflower change (Mohamed S. Radonic., 2006) [7]. Determination of transformants, tissue recovery, long life cycle of sunflower plants, tedious homozygous lines era fundamentally when contrasted with the time required to get homozygous transgenic *Arabidopsis* plants have conceivably made stable change of sunflower to be utilized to illustrate metabolic or flag pathways of sunflowers hard-headed. This has prompted a few reviews to pick *Arabidopsis* or tobacco heterologous framework or transient expression in sunflower leaves to additionally disentangle quality capacities in sunflowers (Manavella and Chan, 2009) [8].

3. DEVELOPMENT OF INSECT TOLERANT TRANSGENIC SUNFLOWERS

A polyphagous creepy crawly *Helicoverpa armigera* (Noctuidae; Lepidoptera) is accounted for to bring about 20-25% yield misfortunes in sunflowers and

now and again up to 40-70% in serious conditions. Velasco L. (2008) [9] found that the sunflower creepy crawly *Zygotroga exclamationis* (25 hatchlings for each plant) decreased seed creation in sunflower as much as 30%.

Cry1F-transgenic sunflowers were acquired with a Cry1F quality ("Bt" quality) disengaged from *Bacillus thuringiensis* which gave resistance against *Spilosoma virginica* and *Rachiplusia nu*. Contrasted with the control, expanded resilience of transgenic plants against hatchlings at the seedling and preflowering stages were found amid the sustaining measure with transgenic leaf circles. Cry1AC quality was utilized to build up a transgenic line of Bt sunflowers by Pioneer Hi-Bred and Dow AgroSciences which create Cry1Ac protein that is deadly to Lepidopteran (moth) hatchlings. Snow et al. (2003) [10] announced that the transgenic plants yielded extensively more inflorescences with more develop seeds in more inflorescences and higher number of feasible seeds per plant when contrasted with non-transgenic controls. They watched that the transgenic plants in a nursery test even without the creepy crawly bugs delivered no distinction in the seeds or inflorescences. The review reasoned that the transgenic itself didn't really bring about the advantage in these transgenic, yet the security from lepidopteran brought about the pickup of fertility in transgenic. They recommended that the wild sunflowers and weedy populaces close to the developed transgenic sunflowers would render repeating occasions of "quality stream" from the transgenic and it could effectively affect the local lepidopteran herbivores and different populaces of coleopteran and dipterans herbivores.

The Development of Fungal Resistant Transgenic Sunflowers

Charcoal spoil ailment brought on by *Macrophomina phaseolina* in sunflower causes misfortunes on more than 500 developed and wild plant species (Khan, 2007) [11]. *Alternaria* scourge brought about by *Alternaria helianthi* is accounted for to diminish seed and oil yield by 27-80% and 17-33% separately (Weber et al., 2003) [12]. *Sclerotinia* has been accounted for to bring about harm upto half in sunflower in UK. Contagious pathogen *Plasmopara halstedii* causes Downy buildup and can prompt over half yield misfortune.

Oxo-transgenic sunflower plants were acquired by presenting wheat germin *gf2.8* OXO quality to give resistance against parasitic malady *Sclerotinia* head decay (Ikeda et al., 2005) [13]. In any case, it has been of concern if OXO compound could be a human allergen. The likelihood of transgenic wild plants being a more terrible weed is rare as OXO transgenic will diffuse impartially on its escape on the grounds that the transgenic wild plants don't create sufficient number of seeds than the wild populace. Chapman and Burke (2006) [14] additionally discounted the likelihood of "quality stream" inferring that the regular choice is the key in spread of great transgenic alleles. Human lysosomes quality under CaMV 35S promoter and No's eliminator in a parallel vector containing NPTII and GUS marker qualities was consolidated in sunflowers utilizing hypocotyls explants with *Agrobacterium*-interceded change gave resistance against form illness bringing about *Sclerotinia sclerotiorum*. Lectin or proteins inhibitor qualities have been utilized to specialist sunflower with bug resistance.

4. THE DEVELOPMENT OF ABIOTIC STRESS TOLERANT TRANSGENIC SUNFLOWERS

Yeast metallothionein quality (CUP1) from yeast was joined into sunflower to assess

resistance of transgenic plants to substantial metals at the callus organize and chose overwhelming metal-tolerant lines of the transgenic sunflower calli. The outcomes indicated utilization of transgenic to acquire a-biotic push resilience in sunflowers (Watanabe et al., 2005) [15]. LBA4404 strain harboring T-DNA containing dsRNA-silencer of praline de-hydrogenase quality, created in view of the ProDH1 quality of Arabidopsis, was incorporated into the genome of sunflower plants changed in vitro and in planta to build sunflower resistance level to water lack and salinity.

5. MOLECULAR PHARMING IN SUNFLOWERS

Plants can realize protein stability and bio-movement by glycosylation and post-translational change, and plant and creature cell protein union pathway are similar; it is evaluated that to blend pharmaceutical proteins

stability, glycosylation, fermentation, in plants is exceedingly economical than utilizing fermentation methods and mammalian cell societies (Rybicki et al., 2010) [16]. This review likewise presumed that the CTB-LK expression in sunflower seeds annihilated the necessity for protein downstream handling. Likewise, the utilization of *Agrobacterium rhizogenes*-interceded change of topinambour in sunflower plants, callus and "furry" root societies ended up being a decent wellspring of recombinant interferon alpha 2b protein. The plasmid vectors with interferon quality combined with *Nicotiana glauca*.

calreticulinoplast focusing on flag driven by 35S CaMV promoter or root-particular M11 promoter to get transgenic *H. tuberosus* societies with high antiviral movement (Maistrenko et al., 2015) [17].

The Development of Sunflowers with Increased Fatty Acid Oil by Mutagenesis

Altering oil quality is pivotal as it is one of the palatable oils overall known for its salubrious quality and lipid per-oxidation. Numerous sunflower lines have been produced with lifted soaked unsaturated fat substance with more noteworthy than 25% of unsaturated fats contrasted with 12% in typical sunflower utilizing physical or concoction mutagenesis. Fernández-Moya et al. (2002) [18] created CAS-14 mutants with upto 37% stearic corrosive substance. It utilized ethyl-methane sulphonate as a concoction mutagen and acquired M2 seeds from a solitary M1 plant with 5-39% palmitic corrosive substance. 10-30% of palmitic corrosive was gotten from the progenies of all chose M2 seeds.

The Development of Transgenic Sunflowers with Increased Fatty Acid Oil

The $\Delta 9$ -stearoyl-(acyl bearer protein) desaturase coding grouping from *Ricinus communis* was moved in sunflower under the control of seed-particular promoter and eliminator arrangements of Hads. Seed oil piece investigation demonstrated noteworthy decline in stearic corrosive substance in the seeds got from transgenic plants. A few progenies displayed immersed unsaturated fat substance underneath 10% though different plants had hoisted palmitic corrosive substance with decreased stearic corrosive substance. Hydroxyl-methyl-glutaryl-CoA (Hmgr-CoA) and *Erwinia uredo* raphytoene desaturase (Crtl) qualities were acquainted into sunflower with get potential increment in oil quality (Dagustu et al., 2008) [19].

Other Molecular Studies in Transgenic Sunflowers

Post-transcriptional quality hushing (PTGS) in transgenic sunflower communicating glucuronidase (GUS) movement has been performed utilizing grafting technique. In two weeks quieting was watched and the review demonstrated that the RNA penetration in sunflower incites transient hushing and is not transmitted to posterity. It has been announced first transgenic sunflower with modification in HAM59 expression to concentrate the capacity of HAM59 MADS-confine quality sunflower which is included in development of regenerative organs of blossom.

The explanation of part of PLFOR48 grouping in imperviousness to buildup in sunflower was contemplated surveying loss of capacity; by communicating antisense DNA PLFOR48 develop in RHA 266 sunflower line. Transgenic sunflower lines showed extreme formative anomalies. The same antisense expression in transgenic tobacco lines brought about higher weakness to *Phytophthoraparasitica*. It was accounted for that TIR-NBSLRR R qualities in sunflower and tobacco have a double part in plant improvement and contagious resistance.

6. CURRENT STIUATION AND CHALLENGES

An advance is as yet being made in productively changing sunflower trims yet stable change of sunflower plants is simply yet tedious in creating homozygous lines and in recovery of tissue. Likewise, sunflower has a long life cycle and transient articulation of qualities can be an option strategy in explaining atomic instruments, for example, capacity of promoters, control of quality, sub cell restriction of proteins, protein stability, protein-protein co-operations and little RNA work. In spite of this imperative, a few reviews by creating transgenic sunflowers are as yet being led.

Wild sunflower species give more noteworthy commitment as a rich wellspring of qualities in yield change to realize financial suitability in develops species as real oilseed worldwide harvest. As having a limited foundation in trained sunflowers with lacking qualities, disclosure of one of kind qualities from wild sunflower plants is essential is as yet in progress. This could help in creating transgenic sunflowers with sought characteristics from wild populace.

Clearfield and Express Sun technologies saw restriction on growing of genetically modified crops for not being biotech product" (Kaya, 2015) [20]. Genetically modified crops have always been a matter of debate and public acceptance regarding this remains divided with some people being reluctant on the use of biotechnology in crop amelioration.

7. FUTURE DIRECTIONS IN GENETIC ENGINEERING OF SUNFLOWER

Transgenic innovation holds basic part in sunflower rearing and applies solid guarantees to build yield, oil content, bug/contagious resistance, stretch resilience and generation of bio-pharmaceutical proteins. Yet having enhanced changed systems in sunflower, more productive change convention should be investigated for creating expanded achievement rates in getting transgenic sunflowers and in addition look for hopeful qualities with first class characteristics in creating transgenic crops remains evident.

Characteristics that are being examined in sunflower for condition discharge is scanty. Sunflower is known to have a high presentation to quality stream eventually creating ceaseless fluctuation. Strict natural observing is unavoidable to block undesired results.

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