eurofins Genomics

MEDICINAL GENOMICS®

Hemp & Cannabis CannSNP90 Chip

The most comprehensive genotyping chip on the market

Highlights

- **World's most comprehensive** SNP chip with over 89K markers
- **Trait specific markers** including cannabinoid genes, terpene genes, plant sex, disease resistance, chemotypes and more!
- **Multiple uses** including genotyping, breeding cultivars with specific chemical profiles, and disease resistance screening
- **High-throughput**

Introduction

Cannabis and hemp are important agricultural crops. Food, Fiber and pharmaceuticals are derived from cannabis and hemp.

The CannSNP90 chip will aid with efforts to breed cannabis cultivars that exhibit specific chemical profiles and disease resistant characteristics. It will also serve as a powerful research tool for enabling more discoveries of quantitative traits and expanding the diversity of Cannabis cultivars assessed in genetic prediction.

The array will be particularly valuable to hemp growers striving to meet the new USDA <0.3% THC regulations, as well as for breeding strains with genes that have been proven to be resistant to powdery mildew, a common and destructive pathogen.

Genotyping chips can greatly accelerate breeding programs looking to optimize yield for grain, fiber or cannabinoid production.

Designing the CannSNP90 Chip

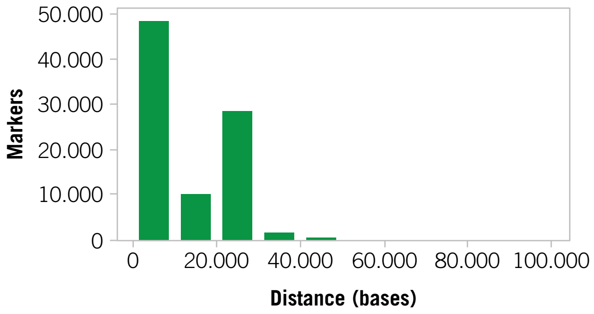
Content for the chip was designed utilizing a Pan Genome approach. A Cannabis Type II Trio (Jamaican Lion) was whole genome sequenced and assembled with the PacBio Sequel II platform. 40 Additional Type I, Type II, Type III, male and female cannabis and hemp plants were whole genome sequenced to over 50X coverage with an Illumina NovaSeq to understand population structure and variation detectable with short read platforms (McKernan et al. 2020). This study included monoecious and dioecious cannabis plants, THCV cannabis plants and powdery mildew resistant cannabis plants. IsoSeq and EMSeq was performed on 4-5 cannabis tissues to help annotate the genomes and classify SNP and indels as highly damaging or moderately damaging. Over 58 million variants were discovered and filtered for population frequency, SNPeff scores, Biallelic status and overlap with genes of interest.

Figure 1:
SNP Chip Technology

We are using a 24 sample bead chip from Illumina to screen our over 89K targets

illumina®

Figure 2: Array Density



Markers on the CannSNP90 Chip

This chip design features several important variants. Overall, over 58M variants were considered for inclusion in the Cannabis SNP Array. They were derived from 40 Type I, Type II, Type III, male and female cannabis and hemp plants which were whole genome sequenced to over 50X coverage.

We have carefully selected 89K variants out of those to be included in our final chip. Those are markers for the below:

- 12.6k distinct genes covered by at least 1 variant
- 3.3k Y-chromosome variants
- Bt:Bd allele to determine Type I, II, III chemotypes
- Multiple variants across THCAS/CBDAS region
- Cannabinoid Synthase genes
  - (THCAS, CBDAS, CBCAS, OLS, OAC, CsPT1,TKS)
- Terpene Synthase genes (Booth et al. 2017; Allen et al. 2019; Zager et al. 2019)
- CannFlavin Synthesis genes (Rea et al. 2019)
  - (PAL, C4H, 4CL, CHS, CHI, F3H, OMT1, CsPTs)
- Pathogen response genes
  - (Chitinases, Thaumatin-Like Proteins, MLO)
- Edestin genes related to seed development
  - (Docimo et al. 2014)
- Even spaced genome wide SNPs
- ~6.5k markers used in Medicinal Genomics (MGC)'s StrainSEEK assay
  - These can be used to calculate the genetic distance of strains in the CannSNP90 Chip to strains in MGC's StrainSEEK database

Ordering Information

For queries or for placing an order, please email **DNACannabis@eurofins.com**

References

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