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CAST 2026: EYES ON THE FUTURE

PHOTOS: VIKRANT DHAWAN AND MOHYUDDIN MIRZA

FROM GENETICS TO HARVEST

Mastering cannabis yield and potency in greenhouse production

BY VIKRANT DHAWAN & MOHYUDDIN MIRZA

Growing cannabis for high potency and high bud yields is a challenge, especially in greenhouses where the outside climate can affect plant performance. Understanding the difference in yields between fully indoor grows and greenhouse grows with supplemental lighting is important, since indoor environments allow for better climate control. The key factors that influence yield and potency must all be carefully integrated to achieve the best harvests.

In this article, we aim to share some on-ground experience in cannabis cultivation, particularly within greenhouse systems where variables are constantly changing.

GENETICS: THE FOUNDATION

Genetics is the starting point as each strain has unique characteristics. Some strains are naturally high yielding, while others emphasize potency or grow more compactly. Sativa-dominant strains can grow tall with ample branching while indica-dominant remain short and bushy. These structural differences influence the plant's potential to produce large, dense buds. Selecting strains based on yield potential is a strategic decision.

CHALLENGES & SOLUTIONS:

- **Mismatch with environment -** Poor performance under greenhouse conditions - Select trial-tested, environment-specific genetics.
- **Yield vs potency trade-off -** Compromised cannabinoid levels or biomass - Choose balanced strains or diversify cultivation.
- **Genetic instability** - Inconsistent growth and

ABOVE

Understanding the difference in yields between fully indoor grows and greenhouse grows with supplemental lighting is important since indoor environments allow for better climate control.

flowering - Use stable genetics and maintain mother plants for cloning.

- **Pest & disease susceptibility** - Reduced yield and quality - Select resilient strains and integrate IPM practices.

THE ENGINE OF GROWTH

Light drives photosynthesis, directly influencing biomass accumulation and cannabinoid production.

In greenhouse cultivation, natural sunlight is a major advantage, but variability due to seasonal shifts, cloud cover, and greenhouse structure can create inconsistencies in plant performance.

Supplemental lighting plays a crucial role in:

- Extending photoperiods to maintain vegetative growth or induce flowering cycles with precision.
- Maintaining consistent light intensity (PPFD), ideally in the range of 600–1,000 µmol/m²/s during flowering depending on cultivar tolerance.
- Supporting flowering during low-light seasons, particularly in winter months when natural DLI (Daily Light Integral) drops significantly.

From a technical standpoint, achieving a target DLI of 30–40 mol/m²/day is critical for maximizing yields.

LED fixtures with adjustable spectra allows for growers to optimize blue light for vegetative growth and red-heavy spectra for flowering and bud development.

Uniform light distribution across the canopy ensures even bud development. Insufficient light leads to small airy buds and lower potency, while excessive or uneven light can cause photobleaching or heat stress at canopy tops.

CHALLENGES & SOLUTIONS:

- **Winter:** Low sunlight - Use supplemental LEDs and light sensors to maintain DLI. Pay particular attention to CO_2 levels around 800 to 1000 ppm.
- **Summer:** Excess light and heat - Install shade curtain (30–50 per cent) to prevent light stress and reduce canopy temperature.
- **Uneven canopy** - Leads to light hotspots - Solve with proper levelling and trellising.

WATER AND NUTRITION

Water and nutrients must be managed with precision, as the root zone is highly sensitive to fluctuations.

Overwatering can suffocate roots, reduce oxygen availability and promote pathogens like Pythium. Underwatering, on the other hand, induces plant stress, limiting nutrient uptake and reducing growth.

A balanced nutrient program should:

- Adjust to plant stages (vegetative vs flowering), with nitrogen driving vegetative growth and phosphorus/potassium supporting flower formation.
- Provide adequate nitrogen early and higher phosphorus/potassium during flowering to support bud density and resin production.
- Do not neglect micronutrients such as, iron, and zinc, which are essential for enzyme activity and plant metabolism.
- Maintain proper EC (typically 1.8–2.5 mS/cm depending on stage) and pH (5.5–6.5) levels for optimal nutrient uptake.

Irrigation strategies such as drip

LEFT

Cannabis plant with healthy roots. The root zone is highly sensitive to fluctuation so water and nutirtion must be handled with precision.

fertigation with controlled runoff (10–20 per cent) help maintain root zone balance and prevent salt buildup.

CHALLENGES & SOLUTIONS:

- **Salt accumulation** - Causes nutrient lockout - Regular leaching and monitoring runoff EC.
- **Calcium deficiency (common in coco)** - Use Ca supplements and maintain proper transpiration.
- **Inconsistent irrigation timing** - Use automated systems with sensors (substrate moisture sensors).

GROWING MEDIUM: BUILDING A STRONG ROOT ZONE

The choice of growing medium directly impacts root health, aeration, water retention, and nutrient buffering capacity.

Common greenhouse media include:

- Coco coir (excellent aeration, high cation exchange capacity, and flexibility in fertigation).
- Rockwool (precision irrigation, uniformity, ideal for high-tech systems).
- Soil or peat blends (natural buffering capacity and microbial activity but less control).

An ideal medium balances moisture retention with oxygen availability, maintaining a healthy rhizosphere. Air-filled porosity of 20 to 30 per cent is optimal for cannabis roots.

CHALLENGES & SOLUTIONS:

- **Compaction over time** - Reduces oxygen - Avoid over-irrigation and use structured media.
- **Uneven dry-down** - Leads to inconsistent growth - Standardize irrigation cycles.
- **Root diseases** - Use beneficial microbes (e.g., *Trichoderma, Bacillus*).

CONTROLLING THE UNCONTROLLABLE

Greenhouse cultivation requires precise climate control to mitigate external environmental fluctuations.

Key parameters include:

- **Temperature:** 22–25°C (day) and 16–20°C (night) for optimal metabolic activity. A 24 hours average temperature of 19 to 20°C is desirable.
- **Humidity:** Maintain VPD (Vapor Pressure Deficit) between 0.8–1.2 kPa for balanced transpiration.
- **Airflow:** Horizontal airflow fans (HAF) ensure uniform conditions and reduce disease risk.
- **CO_2levels:** Supplementation up to 800–1,000 ppm can significantly enhance photosynthesis and yields.

CHALLENGES & SOLUTIONS:

Winter:

- **Challenge:** Low temperature and humidity - Slow growth and nutrient uptake.
- **Solution:** Heating systems, thermal curtains, and humidity control.

Summer:

- **Challenge:** High heat and humidity - Increased risk of mold and heat stress.
- **Solution:** Evaporative cooling, ventilation, and dehumidification.

SHAPING THE CANOPY

Proper plant training ensures efficient light penetration, airflow, and optimal use of greenhouse space.

Important techniques include:

- **Pruning:** Removes lower unproductive growth to focus energy on top colas.
- **Deleafing:** Strategic removal of fan leaves to improve light penetration and airflow.
- **Trellising:** Provides structural support and maintains canopy uniformity.
- **Screen of Green (ScrOG):** This is a highly effective technique where plants are trained horizontally through a mesh screen to create an even canopy. This maximizes light interception and increases yield per square metre.

A well-managed canopy ensures all bud sites are receiving adequate light, reducing variability and improving overall quality.

CHALLENGES & SOLUTIONS:

- **Overcrowding -** Leads to humidity pockets - Increase spacing and airflow.
- **Uneven canopy height** - Causes inconsistent bud size - Use ScrOG or topping techniques.
- **Excessive defoliation** - Reduces photosynthesis - Maintain balance.

PROACTIVE DISEASE AND PEST CONTROL

Preventing problems is far more effective than reacting to them.

A proactive strategy includes:

- Regular crop scouting using yellow sticky traps and visual inspection.
- Biological controls and integrated pest management (IPM), including beneficial insects like predatory mites.
- Maintaining hygiene and sanitation protocols.
- Monitoring humidity closely to prevent fungal outbreaks such as powdery mildew and botrytis.

CHALLENGES & SOLUTIONS:

- **Spider mites in hot, dry conditions** - Introduce biological predators early.
- **Powdery mildew in high humidity** - Maintain airflow and apply preventive bio fungicides.
- **Late detection** - Leads to crop loss - Implement routine scouting schedules.

Healthy plants allocate more energy to growth and cannabinoid production rather than stress responses.

HARVEST: TIMING IS EVERYTHING

Harvest timing significantly influences both yield and potency.

Key considerations:

- Monitor trichome development (clear - cloudy - amber) using magnification.
- Harvest during optimal environmental conditions to avoid moisture issues.
- Handle plants carefully to preserve delicate trichomes and resin glands.

Wet weight provides an initial measure of biomass but can be misleading due to high moisture content. Typically, dry weight is 20–25 per cent of wet weight depending on drying efficiency.

CHALLENGES & SOLUTIONS:

- **Early harvest due to schedule pressure** - Lower potency - Plan harvest windows carefully.

THE FINAL COUNTDOWN

Post-harvest handling is critical for preserving quality, potency, and terpene profile.

Proper drying and curing:

- Enhance terpene profile through slow moisture reduction.
- Stabilize cannabinoids and prevent degradation.
- Prevent mold through controlled conditions (18–22°C and 50–60 per cent RH).

Drying should occur over six to 10 days depending on bud size and density, followed by curing in controlled environments. Final dry weight is the true measure of yield and economic return.

CHALLENGES & SOLUTIONS:

- **Over drying** - Loss of terpenes - Use humidity-controlled storage (58–62 per cent RH packs).
- **Mold during drying** - Improve airflow and reduce humidity immediately.
- **High-quality packaging** ensures shelf stability while maintaining potency and aroma.

INTEGRATION DRIVES EXCELLENCE

High cannabis yields and potency are not the result of a single factor but the outcome of a fully integrated cultivation system.

Greenhouse cultivation presents unique challenges, particularly during extreme winter and summer conditions, but it also offers an opportunity to combine natural and controlled environments for optimized production.

Growers who understand and align these factors—while adapting to real-time challenges—will achieve superior harvests in both quantity and quality.

Vikrant Dhawan is a plant scientist and master grower at Green Mountain Health Alliance greenhouse facility in Kaleden, BC and can be reached at vdhawan@gmtn.ca.

Dr. Mohyuddin Mirza is an industry consultant in Alberta and welcomes comments at: drmirzaconsultants@gmail.com.