Societa' Agricola
Penati Mario e Matteo S.s.

Societa' Agricola
Penati Luigi e C S.s.

Seminario del Gruppo Operativo
CANAPRO
Valorizzazione della filiera della canapa attraverso l'innovazione di prodotto e di processo

MODELLI DI CRESCITA E POTENZIALITÀ DI APPLICAZIONE PER LA CANAPA

Gabriele Cola
Dipartimento di Scienze Agrarie e Ambientali
Università degli Studi di Milano

Fondo Europeo Agricolo per lo Sviluppo Rurale: l'Europa investe nelle zone rurali

Iniziativa realizzata nell'ambito del Gruppo Operativo (CANAPRO), cofinanziato dal FEASR
Operazione 16.1.01 "Gruppi Operativi PEI" del Programma di Sviluppo Rurale 2014-2020 della Regione Lombardia
Capofila del partenariato è l'Università degli Studi di Milano, realizzato con la collaborazione di CREA-ZA, Fondazione Bolognini, Società agricole Next Farm, Penati Mario e Matteo, Penati Luigi, Madreterra. Autorità di gestione del Programma: Regione Lombardia

MODELLI DI CRESCITA DELLE COLTURE AGRARIE

La modellistica di produzione è una branca della agronomia che mira a:
mettere a sistema le più avanzate conoscenze relative alla biologia ed alla fisiologia delle piante coltivate in modo da poterne descrivere/simulare i diversi processi di sviluppo

Tali strumenti, che necessitano di una consistente quantità di dati per il loro sviluppo e le successive fasi di calibrazione e validazione, possono essere utili per:

- Analizzare le stagioni pregresse al fine di ottimizzare le pratiche agronomiche, evidenziando i punti deboli del processo produttivo
- Mettere confronto gestioni alternative valutandone pro e contro
- Prevedere la riposta della coltura nel corso della stagione (sulla base di dati meteorologici previsti)

Il tutto può essere applicato alla scala di singolo campo come a diverse scale territoriali

SVILUPPO DI MODELLI DI CRESCITA SIA PER LA COLTIVAZIONE IN PIENO CAMPO ED IN SERRA

L'obiettivo è procedere allo sviluppo di un modello di simulazione della produzione che consideri:

- Le diverse cultivar
- L'ambiente di crescita
- Le variabili guida ambientali

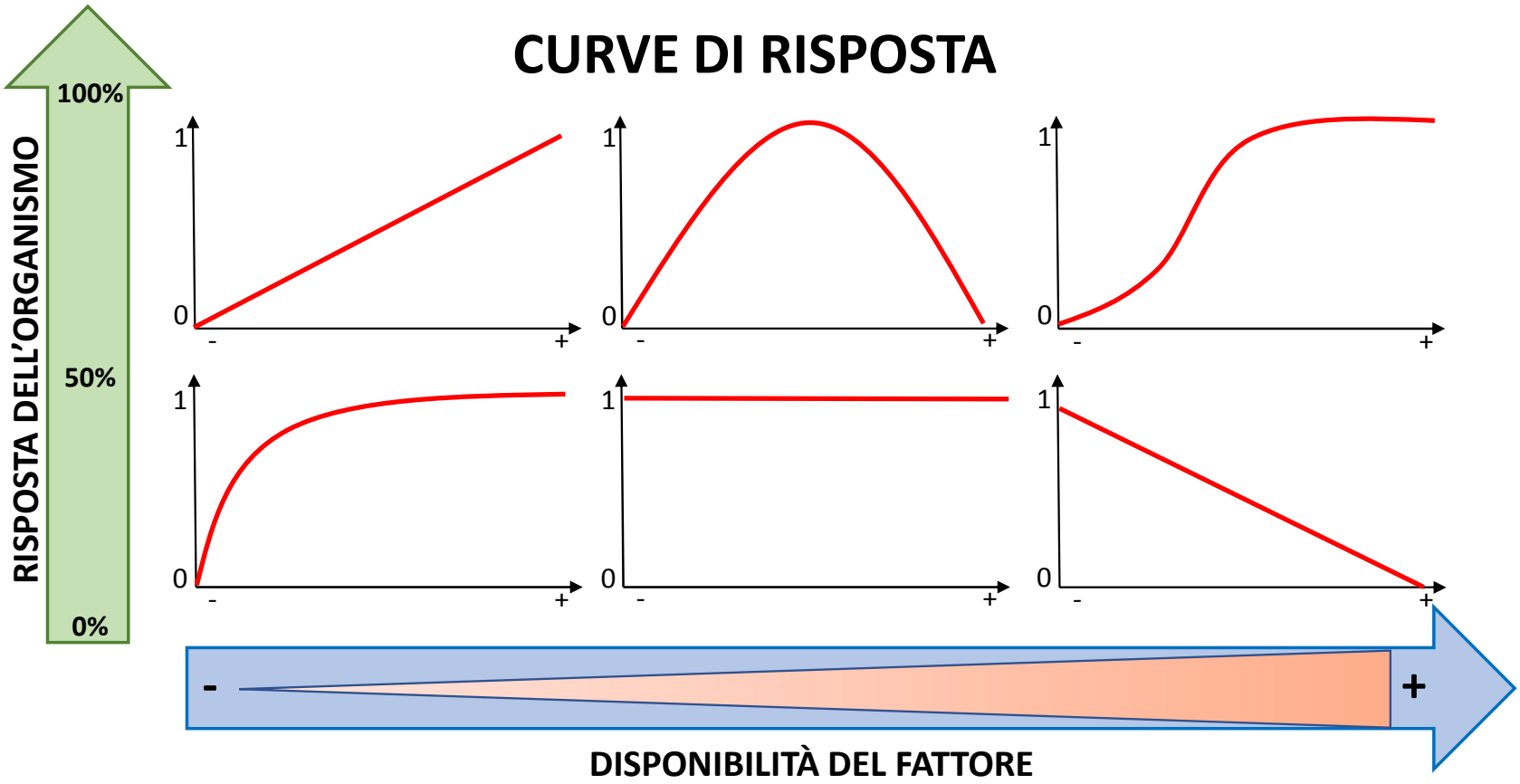
Al fine di descrivere:

- Lo sviluppo fenologico della coltura
- L'accumulo della biomassa
- L'accumulo di olio negli organi di riserva
- …

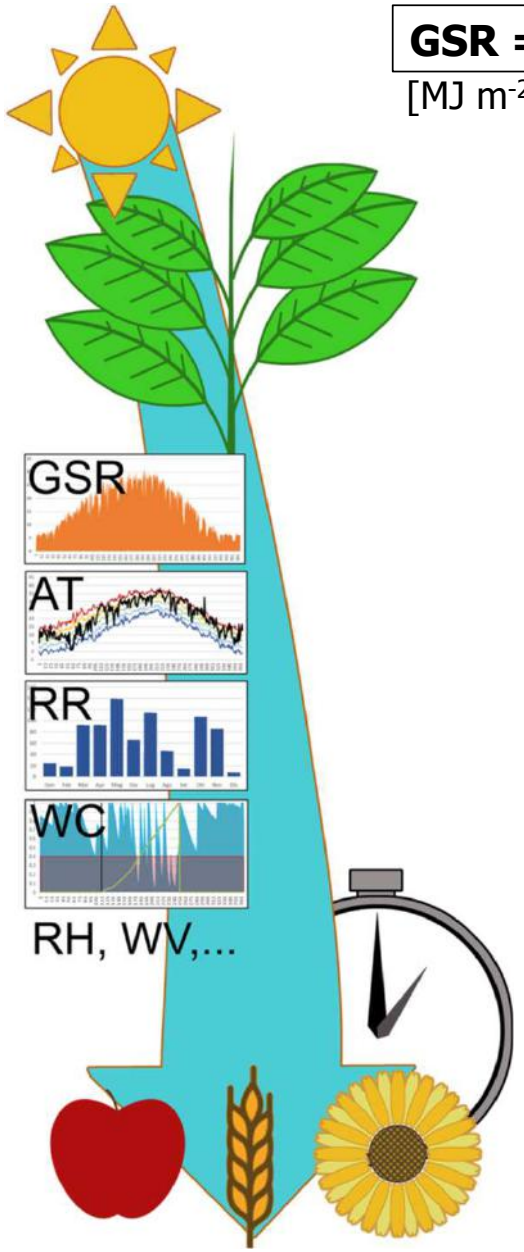
NECESSITÀ DI RACCOGLIERE DATI RELATIVI ALL'ANDAMENTO DELLE VARIABILI GUIDA AMBIENTALI ED ALLE CARATTERISTICHE BIOMETRICHE E PRODUTTIVE DELLA COLTURA

FATTORI DELLA PRODUZIONE E ORGANISMI

- Disponibilità del fattore (quantità e qualità)
- Relazione fra l'organismo e i fattori
  (risposta dell'organismo alla disponibilità del fattore)



MODELLO DI PRODUZIONE



GSR = Radiazione Solare Globale

[MJ m^{-2}] - Variabile guida del sistema, fonte di energia

PAR = Radiazione Fotosinteticamente Attiva

[MJ m^{-2}] - Si considerano solo le lunghezze d'onda utili alla fotosintesi

APAR = Radiazione Fotosinteticamente Attiva Assorbita

[MJ m^{-2}] - Viene intercettata una frazione di PAR in funzione del **LAI**

GASS = Assimilazione Lorda

[g(CH_2O) m^{-2}] Mediante **RUE** (*Radiation Use Efficiency*)

PNA = ASSIMILAZIONE POTENZIALE NETTA

[g(CH_2O) m^{-2}] - Perdite di biomassa dovute a:
RESPIRAZIONE, CONVERSIONE, TRASLOCAZIONE

PNA_TL = PNA LIMITATA TERMICAMENTE

[g(CH_2O) m^{-2}] - Perdite da **LIMITAZIONI TERMICHE**

NPP = PNA_TL_WL = PRODUZIONE PRIMARIA NETTA

[g(CH_2O) m^{-2}] - Perdite da **LIMITAZIONI IDRICHE**

+ ALTRE LIMITAZIONI *[nutrienti, fitopatie,...]*

STRESS

NPP VIENE QUINDI RIPARTITA NEI DIVERSI ORGANI DELLA PIANTA, A SECONDA DELLO STADIO FENOLOGICO

PROVA IN SERRA – UNIMI

2021

Cultivar:

1. Carmagnola (dioica)
2. Carmagnola selezionata (dioica)
3. Felina 32 (monoica)
4. Futura 75 (monoica)
5. USO 31 (monoica)
6. Santhica 27 (monoica)

Semina in plateau: 15 Ottobre

Trapianto in vaso: 29 Ottobre

Gestione della radiazione:

1. Naturale + LED
2. Naturale + HPS

2022

Cultivar:

1. Carmagnola (dioica)
2. Carmagnola selezionata (dioica)
3. Felina 32 (monoica)
4. Fedora (monoica)
5. Futura 75 (monoica)
6. USO 31 (monoica)
7. Santhica 27 (monoica)
8. Zenit (monoica)
9. Jubileu (monoica)

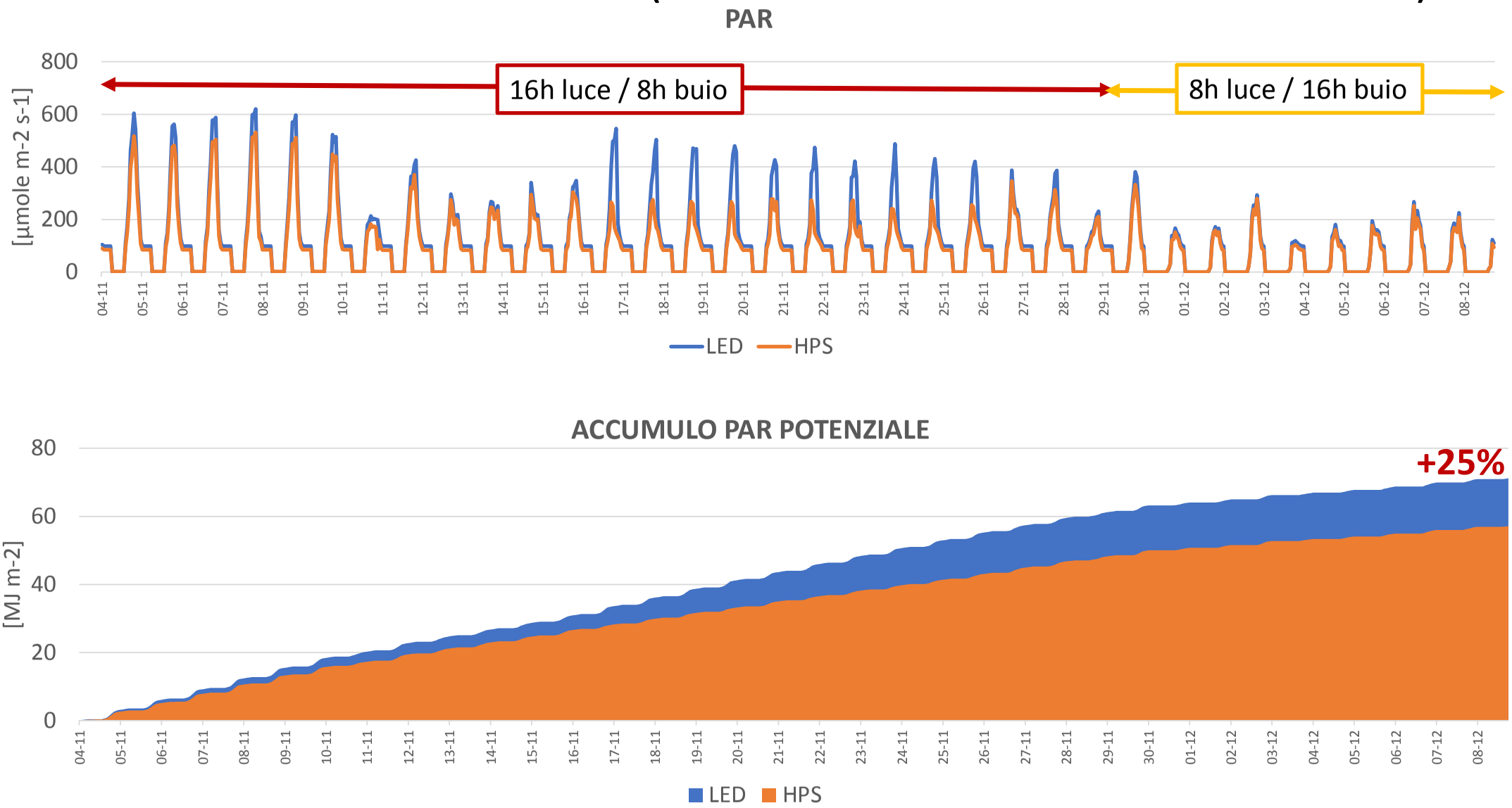
Semina in plateau: 28 Settembre

Trapianto in vaso: 15 Ottobre

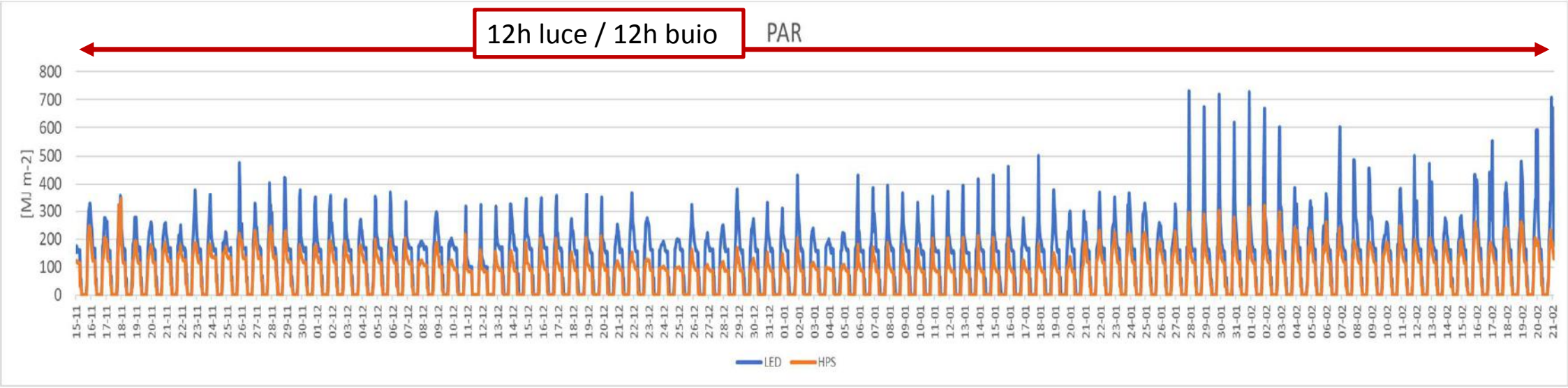
Gestione della radiazione:

1. Naturale + LED
2. Naturale + HPS

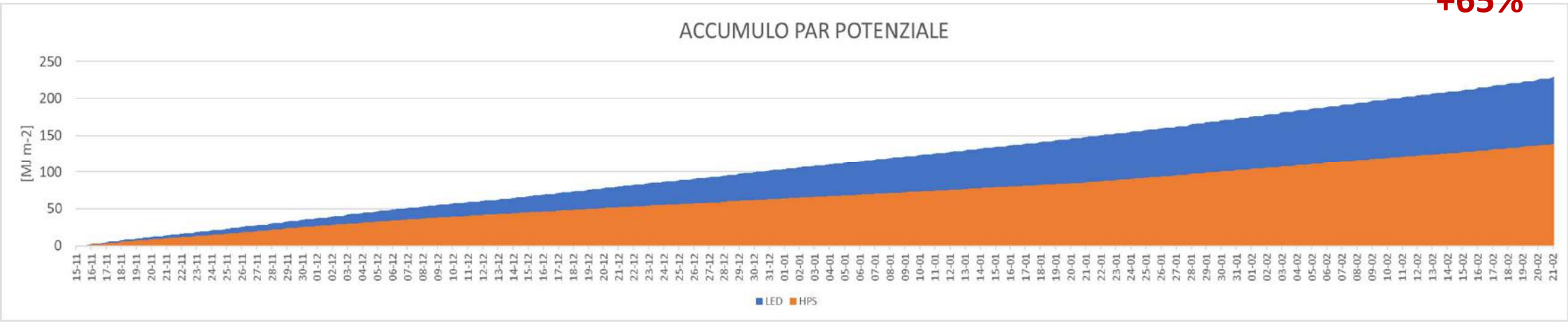
2021 REGIME RADIATIVO (ambiente + illuminazione artificiale)



2022 - REGIME RADIATIVO (ambiente + illuminazione artificiale)

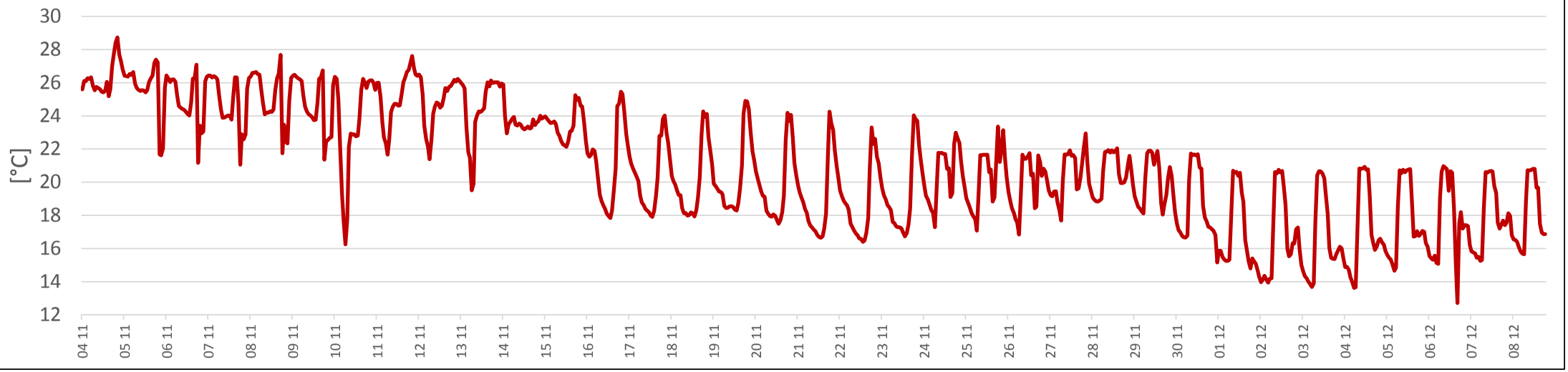


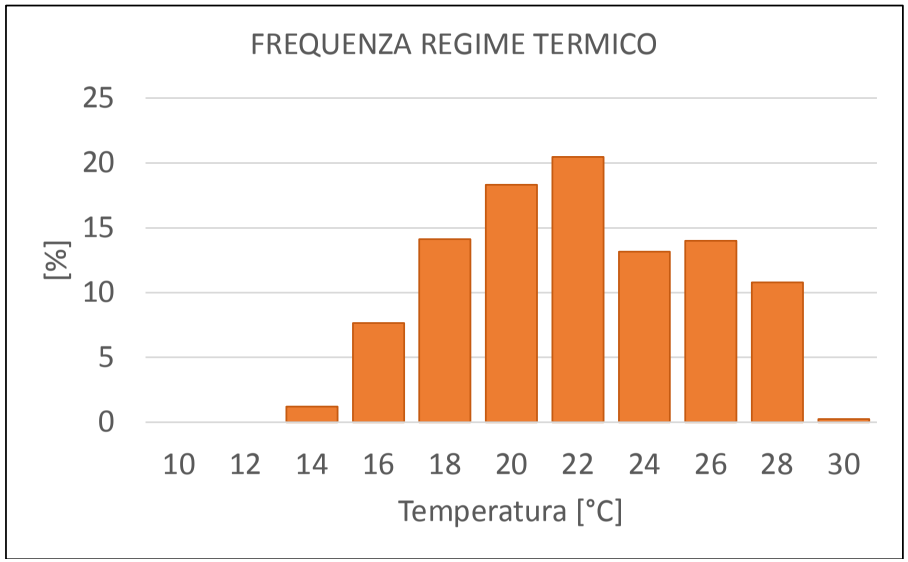
+65%



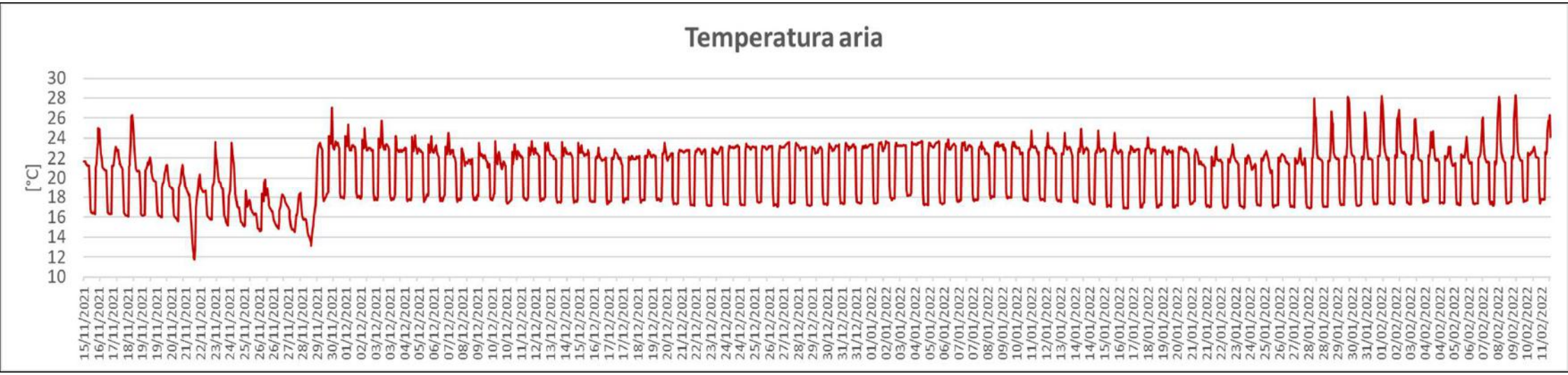
2021 REGIME TERMICO

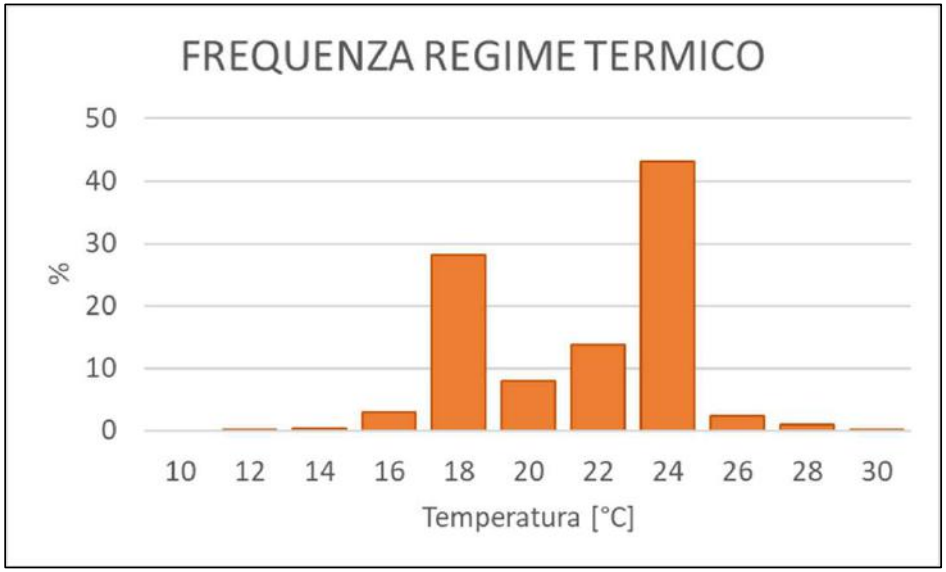
Temperatura aria



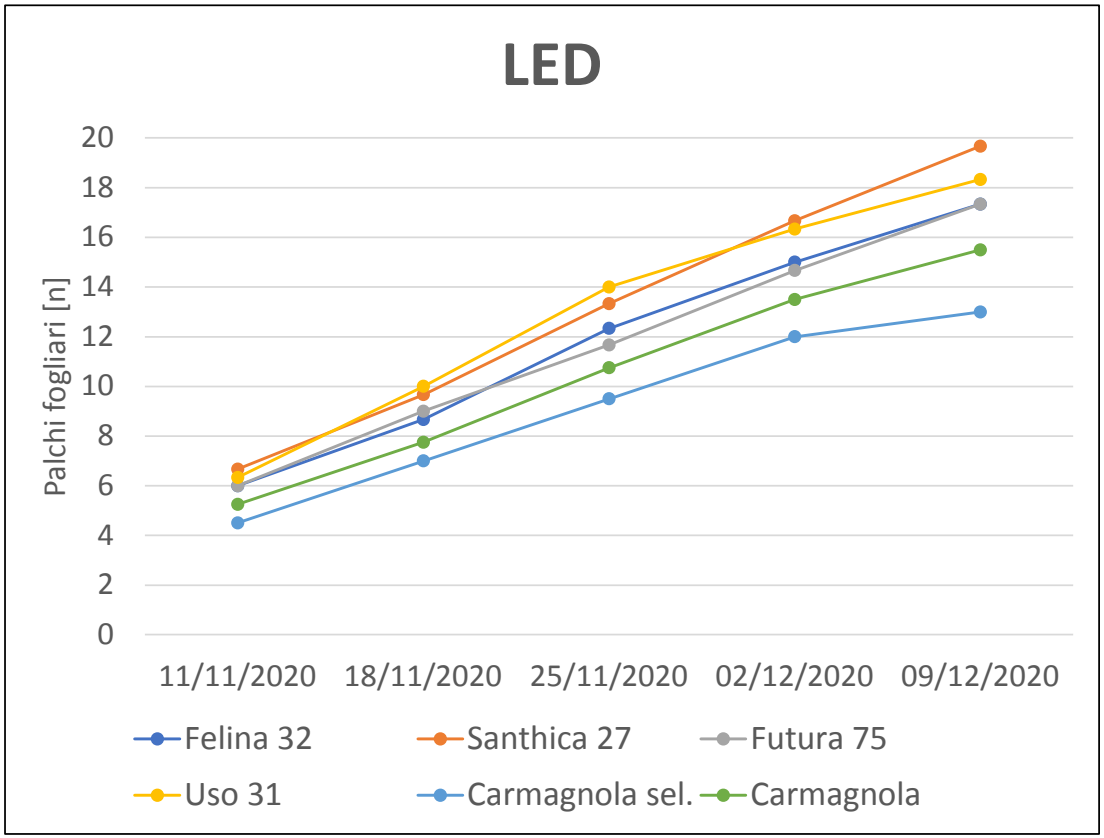


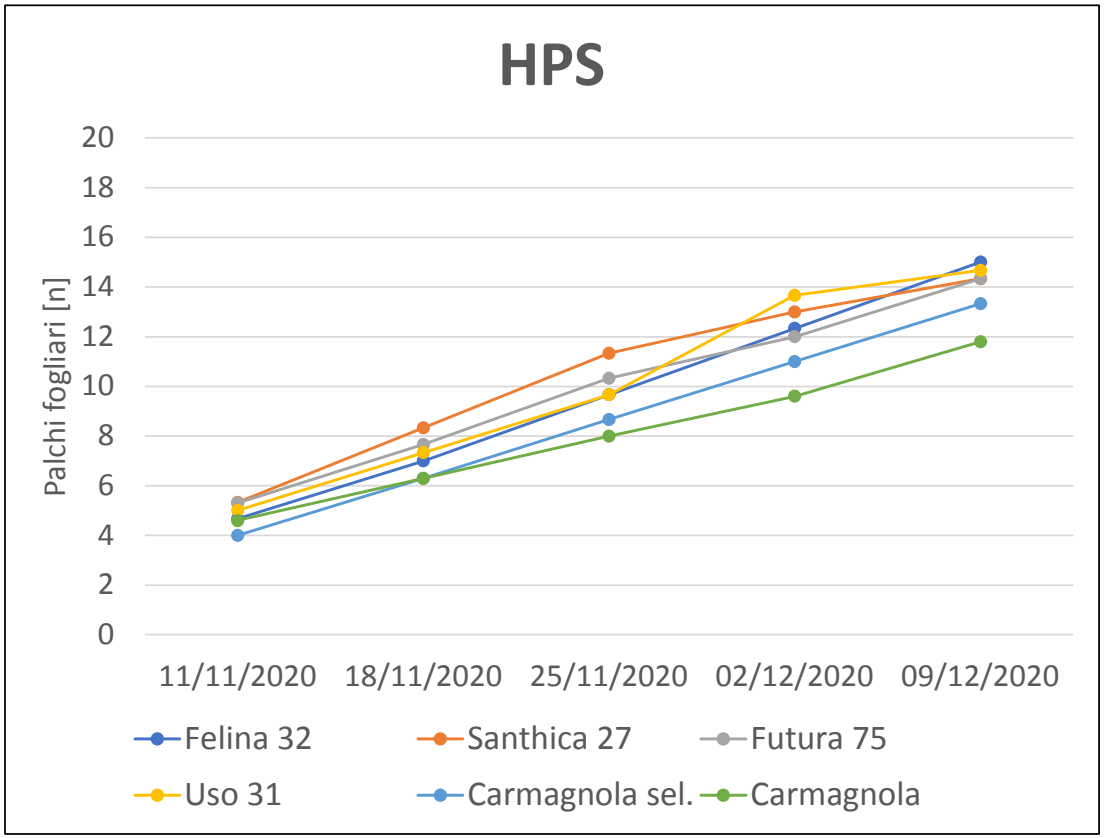
2022 - REGIME TERMICO



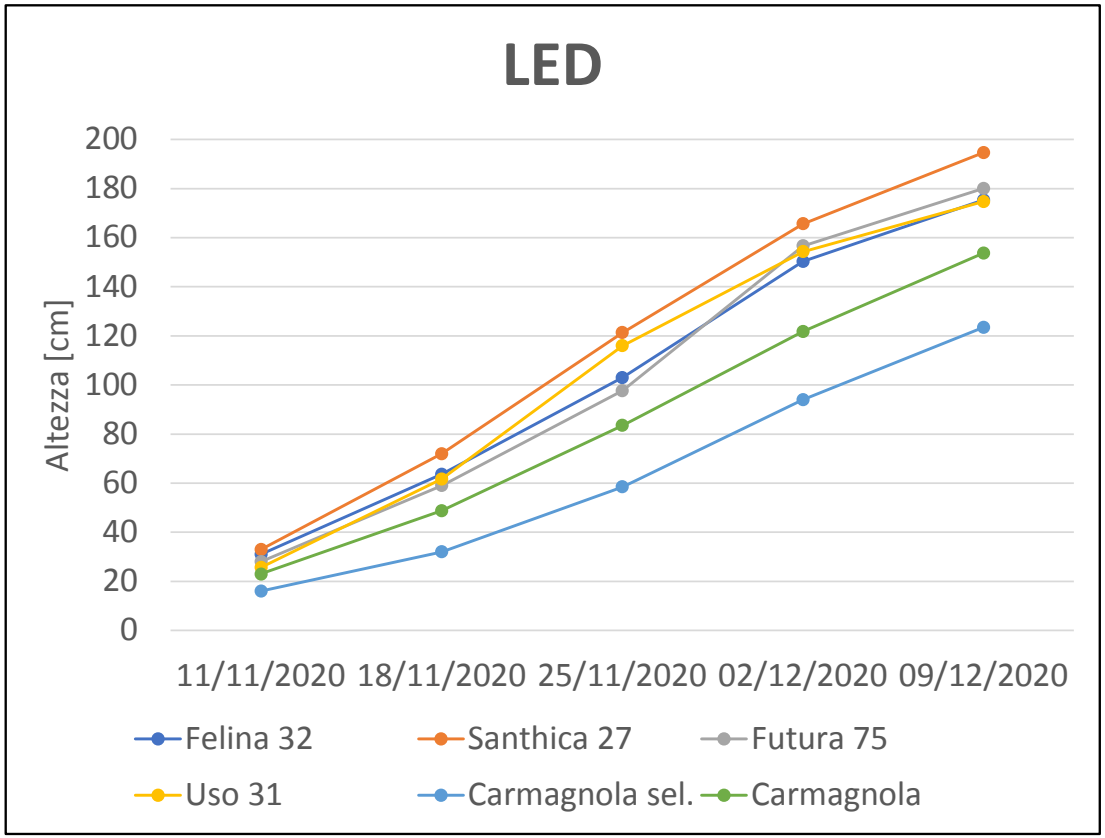


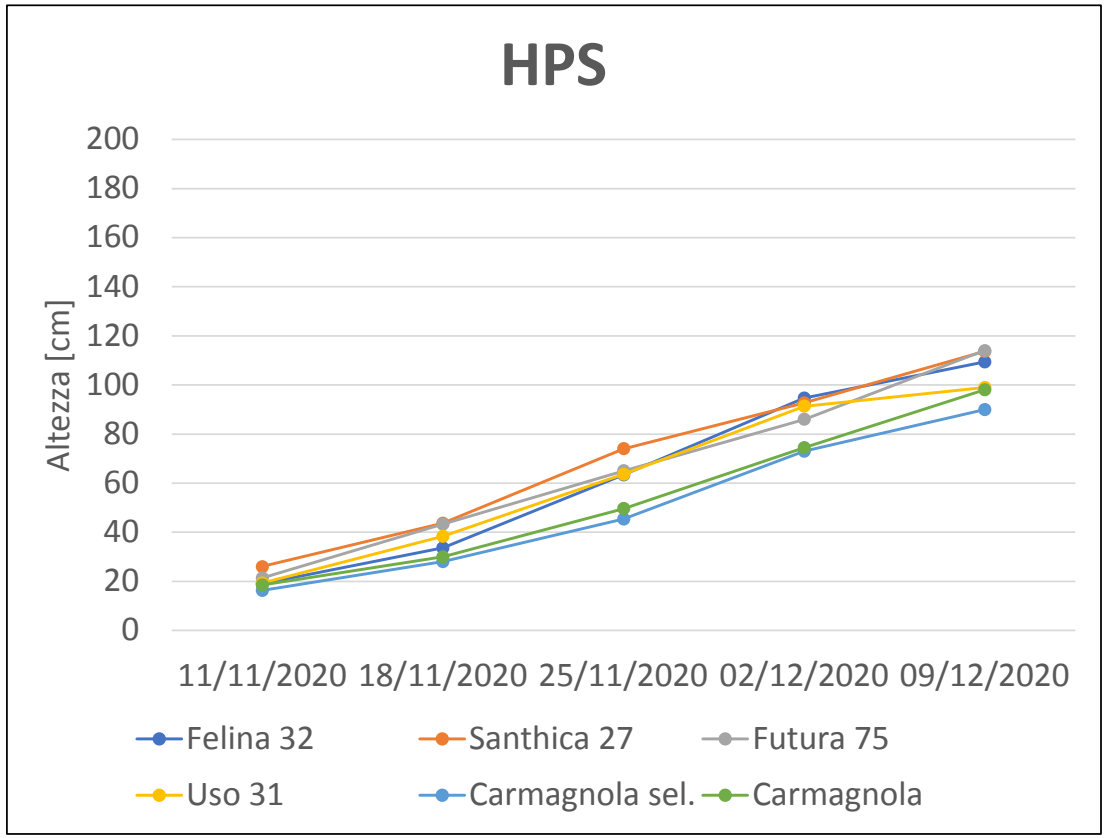
2021 - FENOLOGIA – SVILUPPO APPARATO FOGLIARE



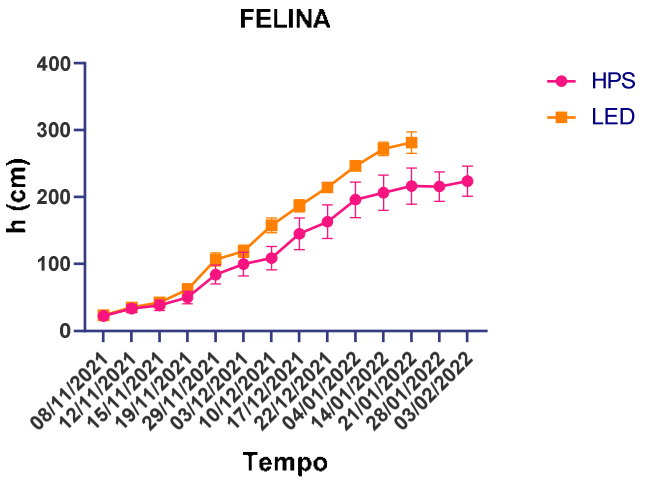


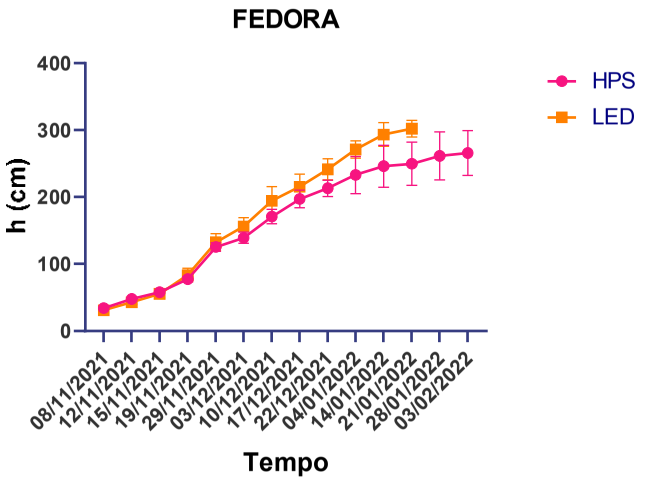
2021 - FENOLOGIA – ALTEZZA PIANTE

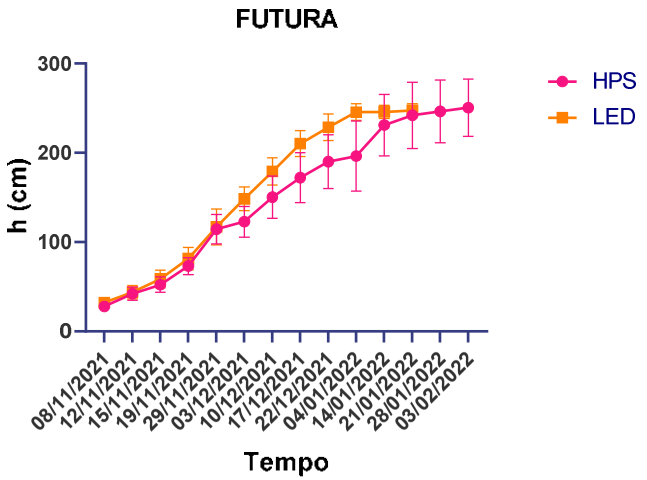


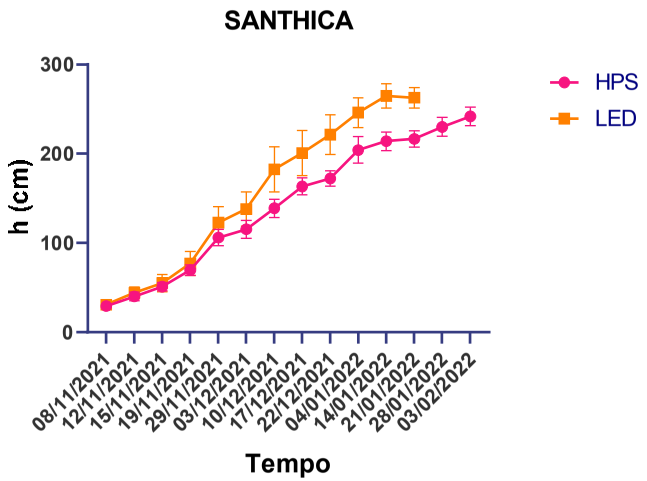


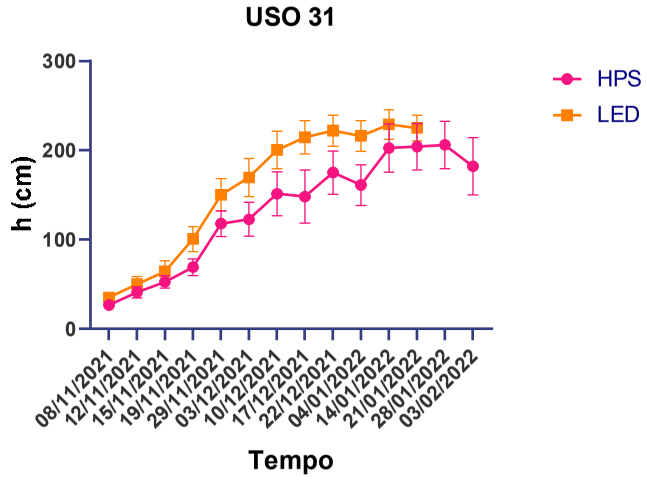
2022 - Analisi morfologiche - Altezze

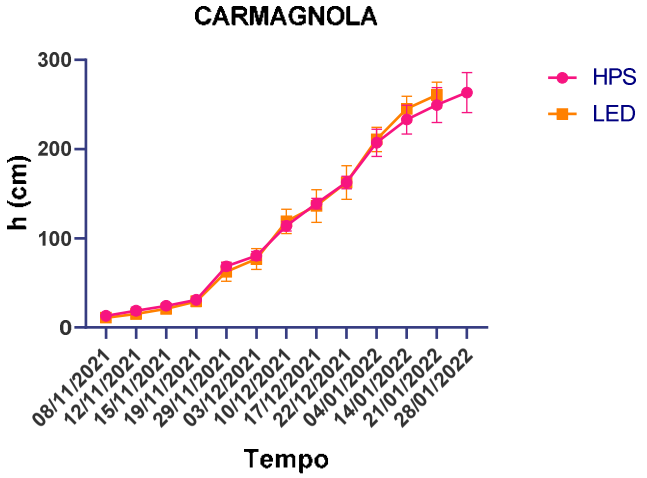




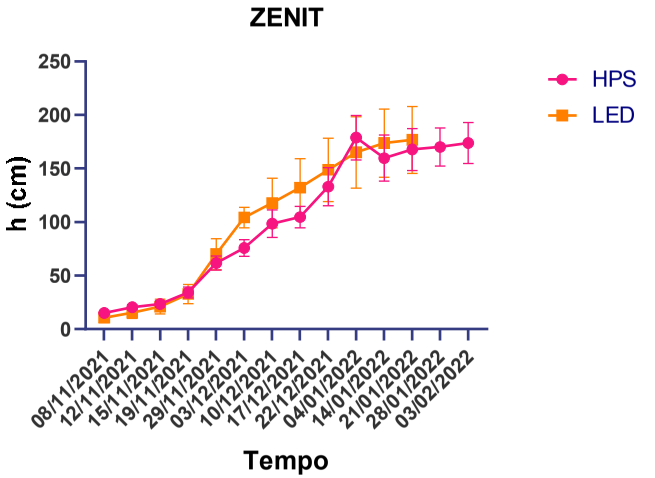


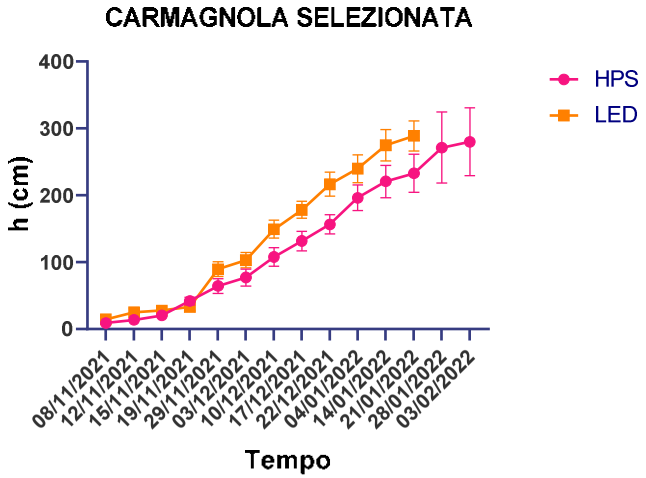


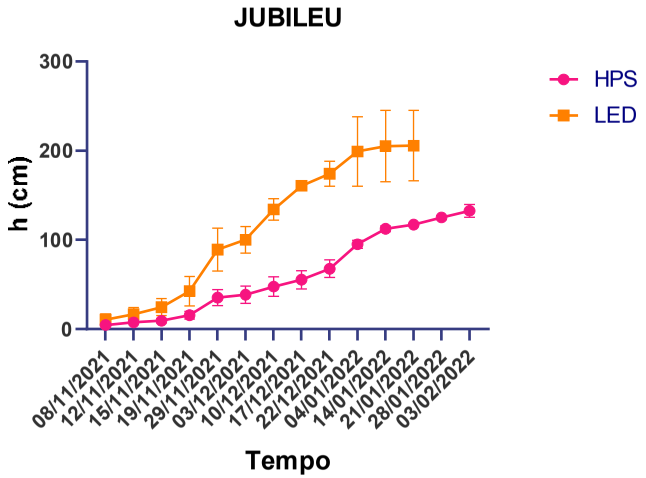




2022 - Analisi morfologiche - Altezze

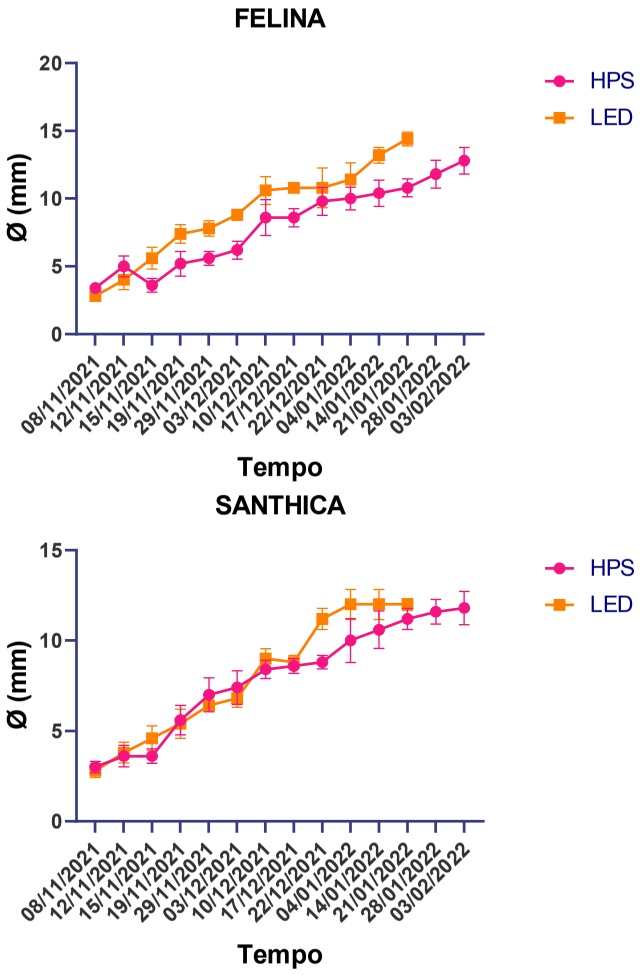


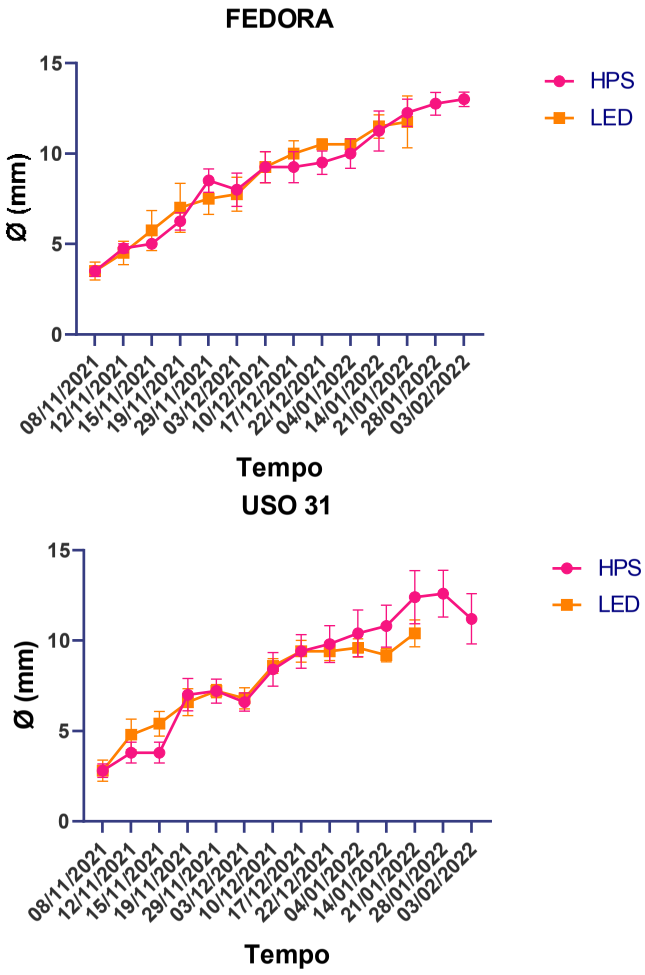


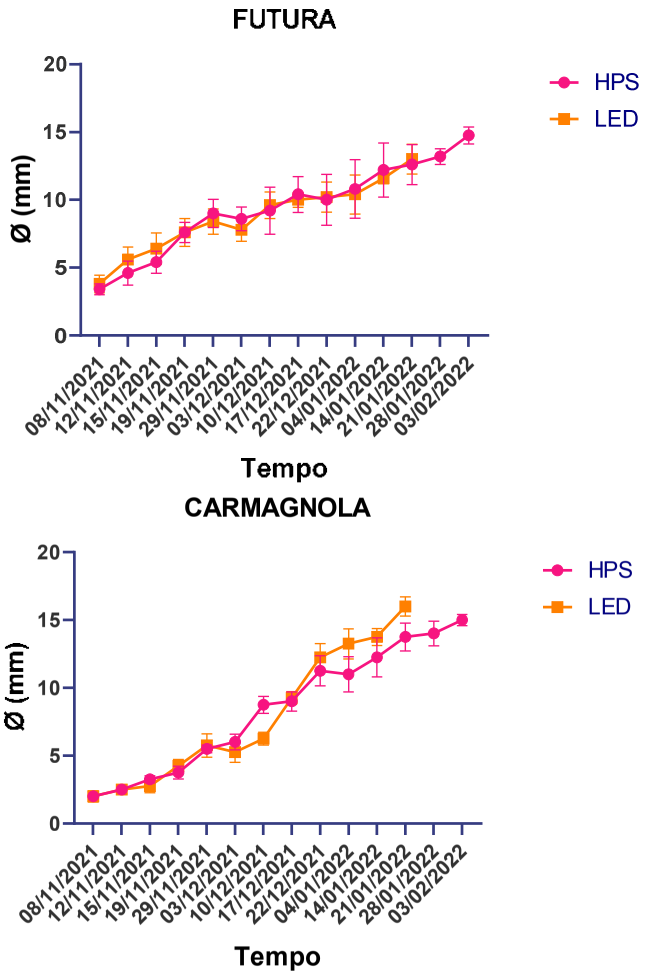


LE TESI SOTTO LED MOSTRANO MEDIAMENTE UNA ALTEZZA FINALE MAGGIORE E UN PIÙ ELEVATO RITMO DI SVILUPPO

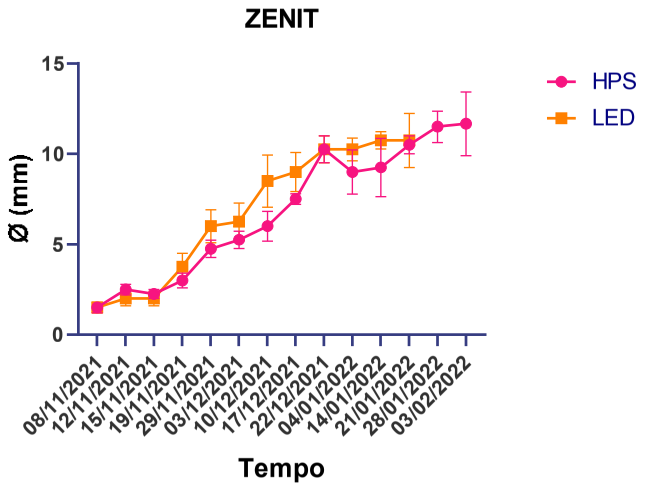
2022 - Analisi morfologiche - Diametro steli

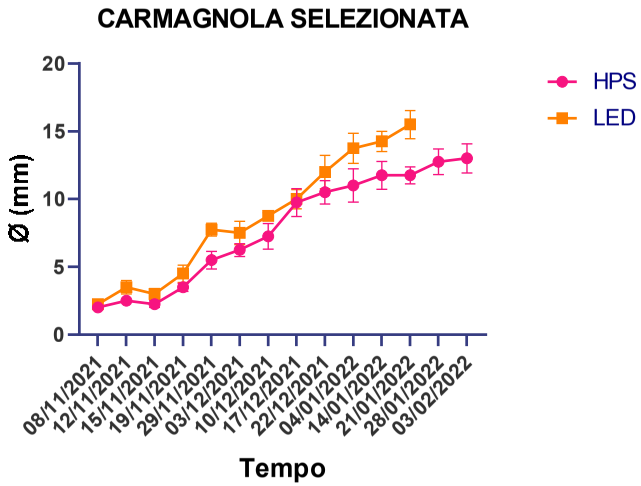


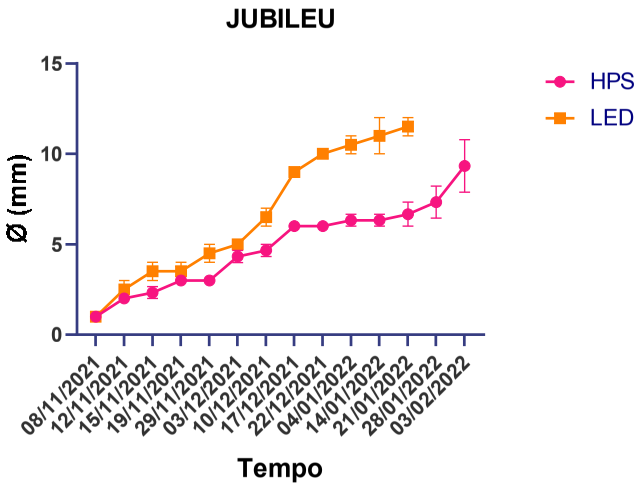




2022 - Analisi morfologiche - Diametro steli

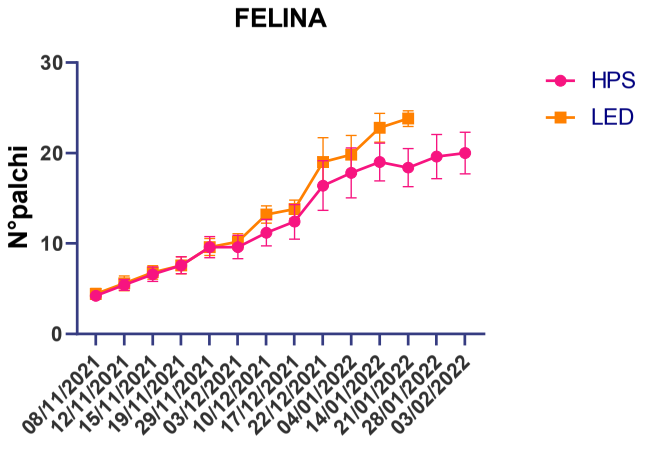


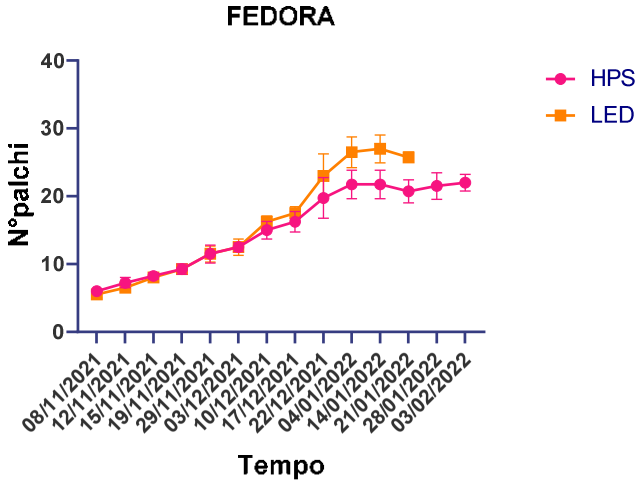


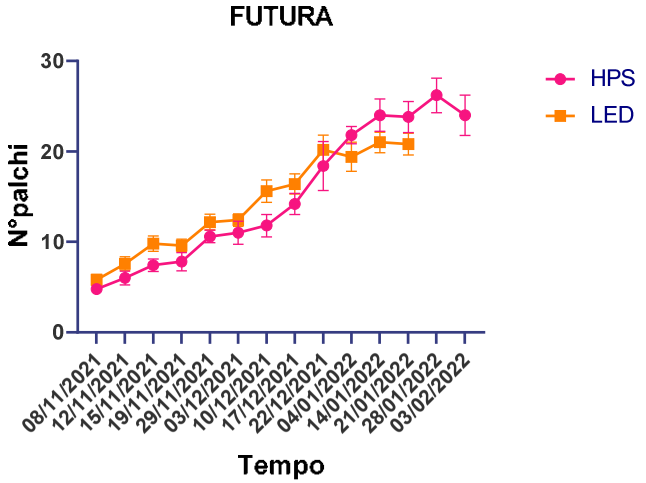


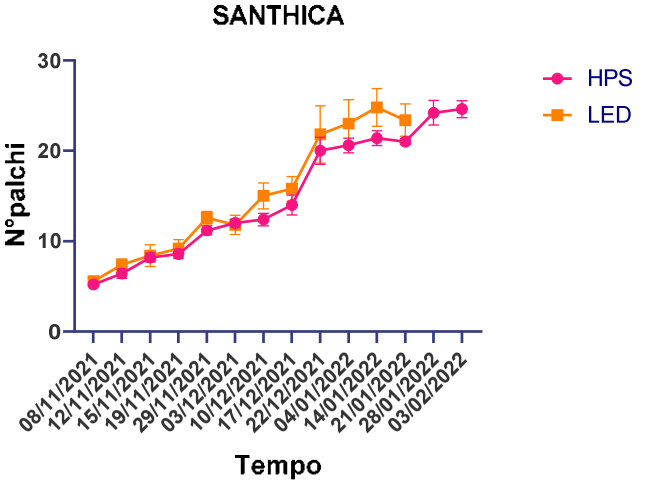
JUBILEU, CARMAGNOLA SELEZIONATA E PARZIALMENTE FELINA -> AUMENTO DEL DIAMETRO
NESSUNA DIFFERENZA NELLE ALTRE VARIETÀ

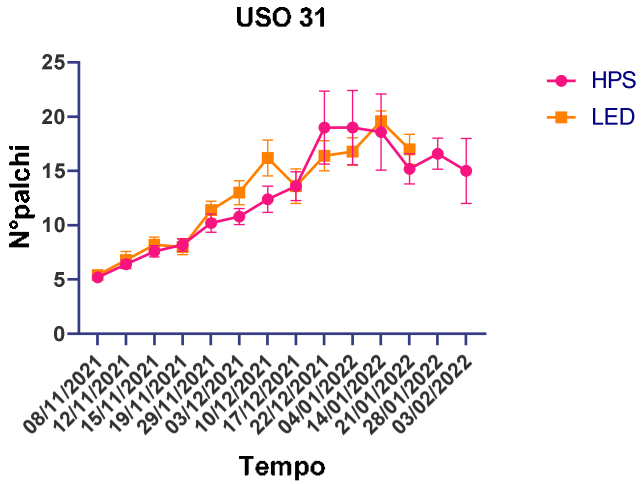
2022 - Analisi morfologiche-Numero dei palchi

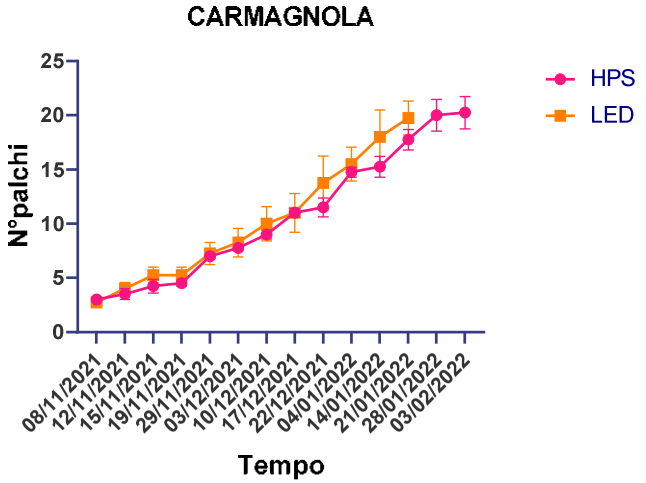




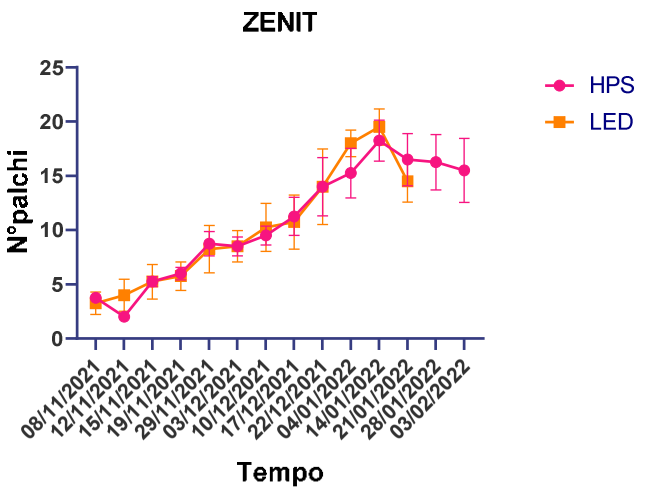


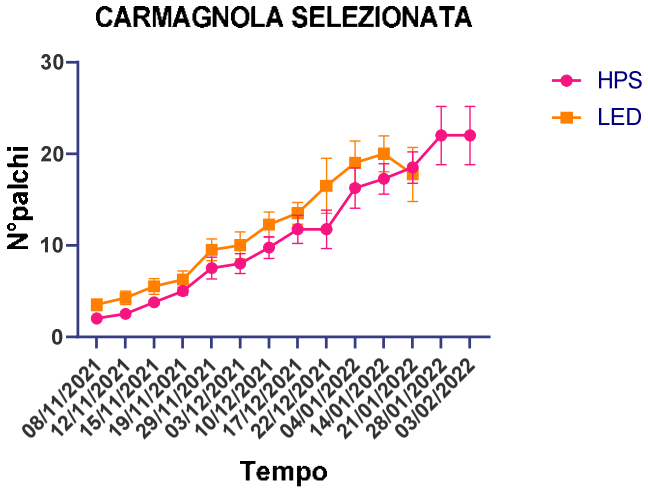


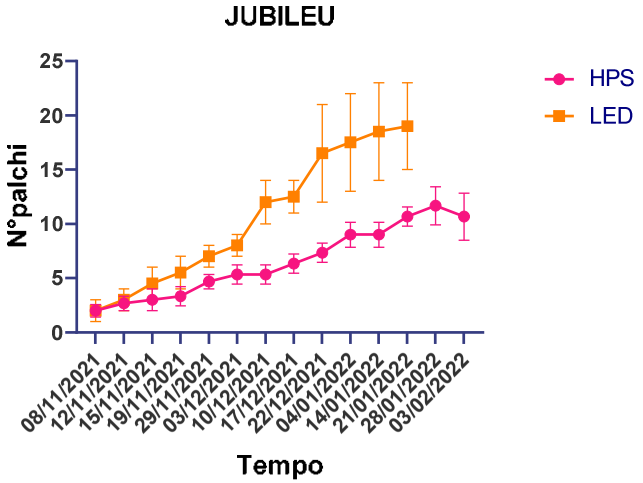




2022 - Analisi morfologiche-Numero dei palchi

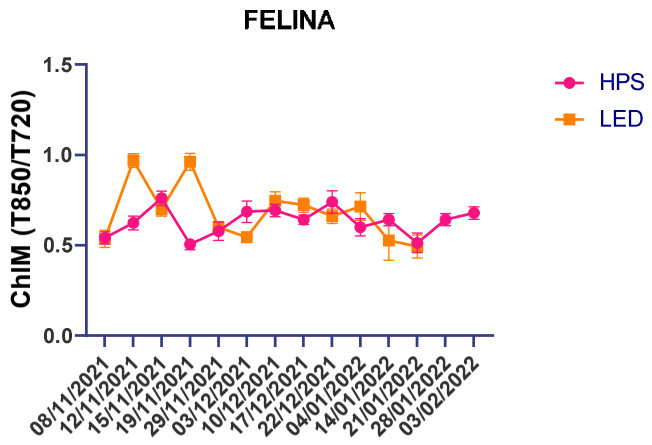


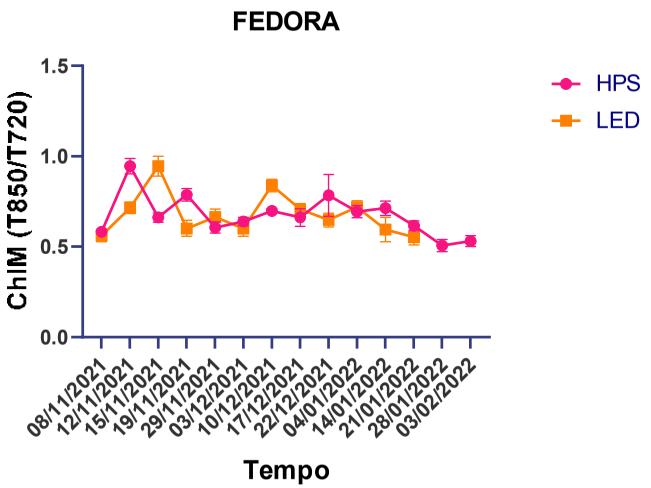


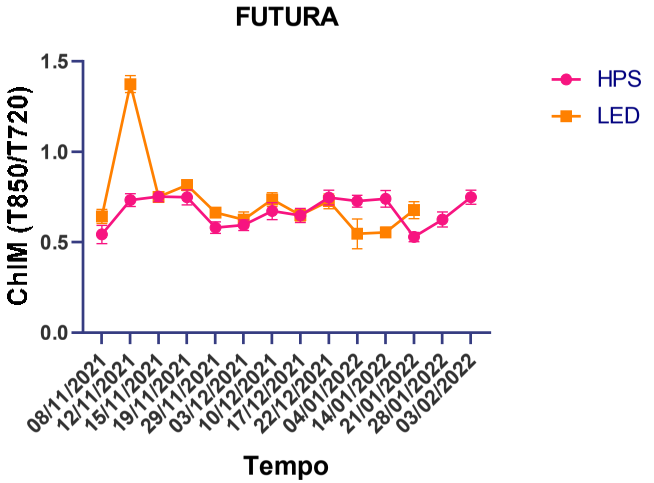


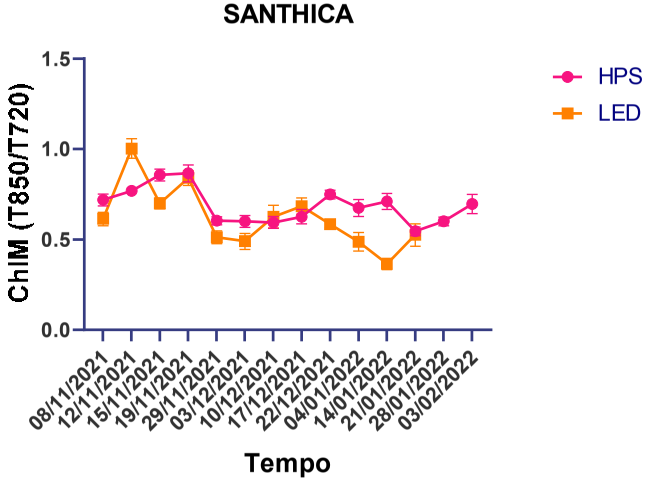
JUBILEU DIFFERENZE SIGNIFICATIVE
FELINA E FEDORA, DIFFERENZE NELLE FASI PIÙ AVANZATE DI SVILUPPO

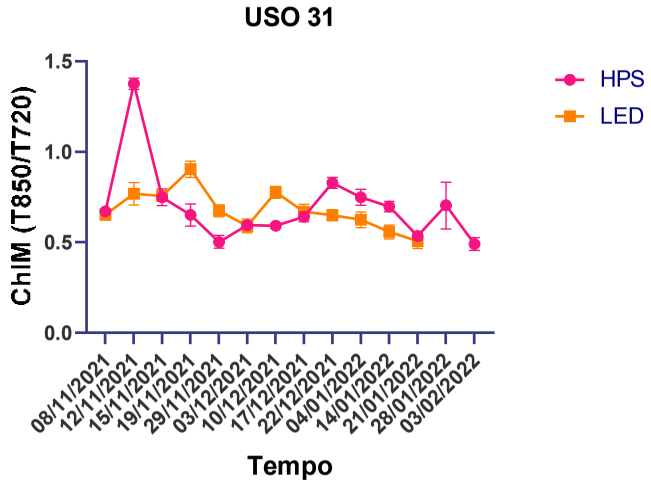
2022 - Analisi in vivo - Contenuto di clorofilla

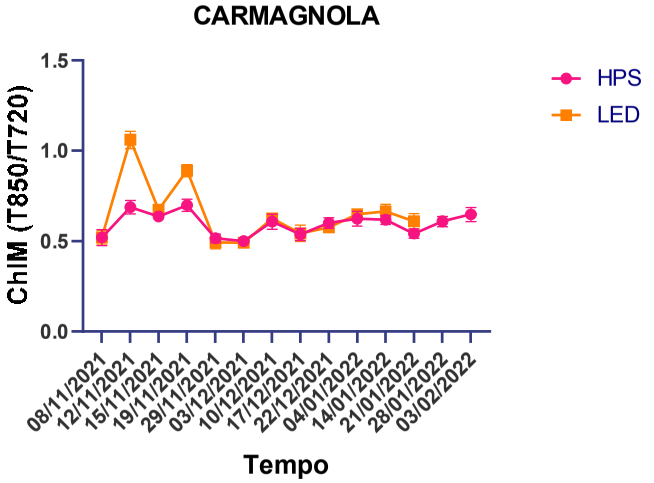




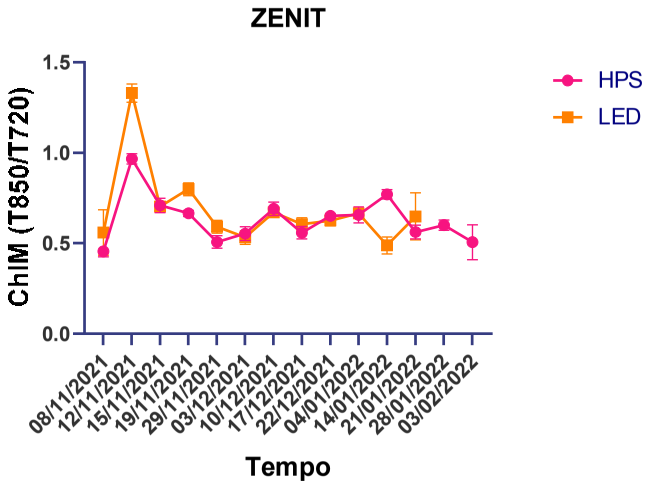


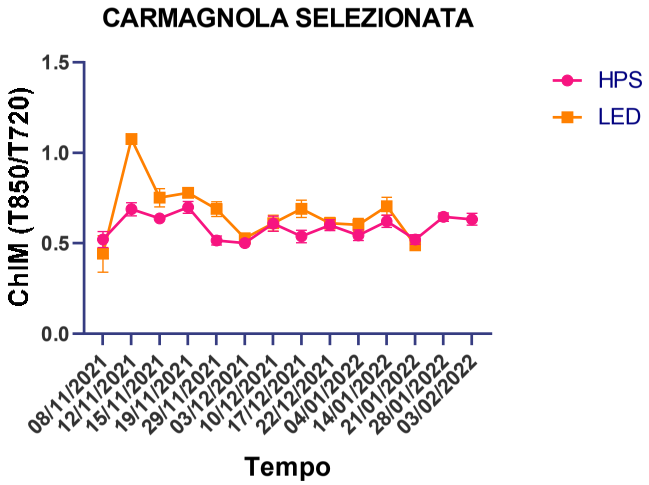


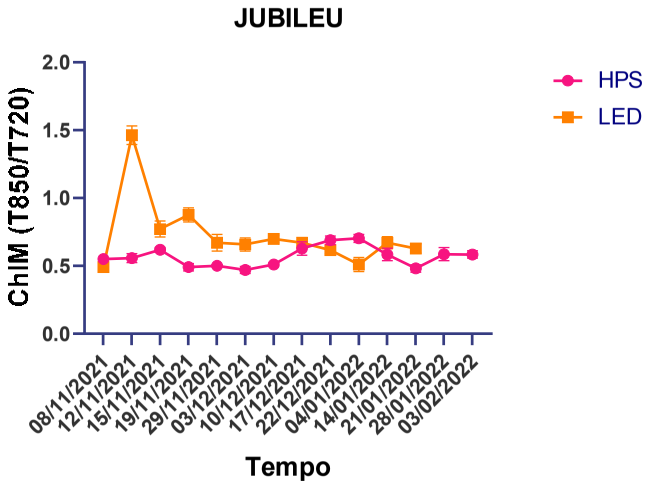




2022 - Analisi in vivo - Contenuto di clorofilla



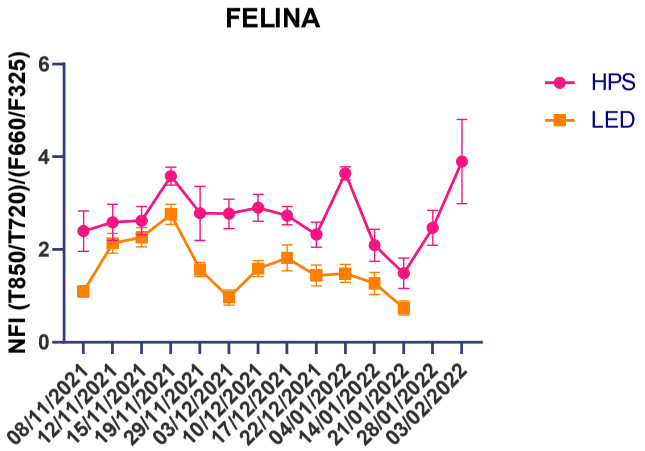


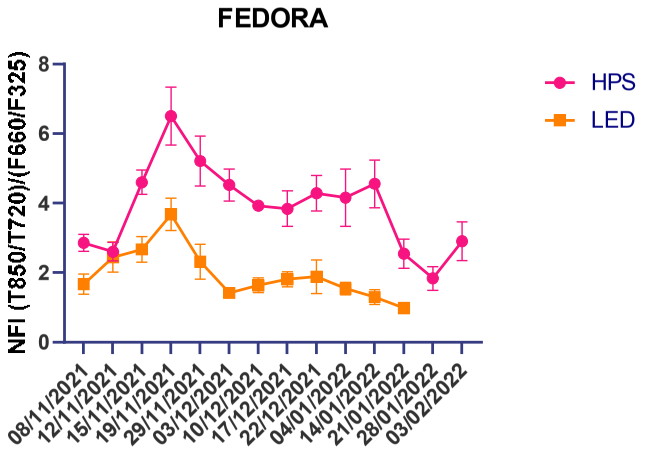


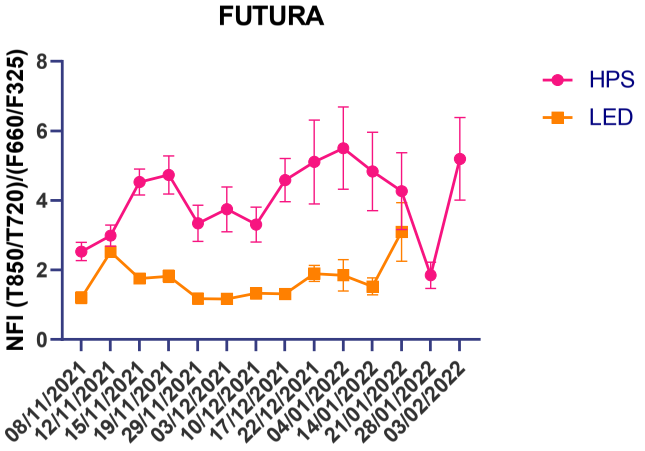
ESTREMA STABILITÀ FRA LE VARIETÀ

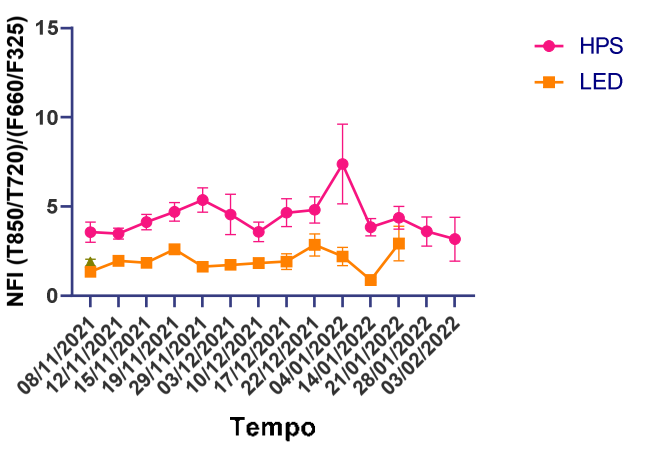
PICCO INIZIALE CHE PUÒ ESSERE IMPUTATO ALLE FOGLIE GIOVANI

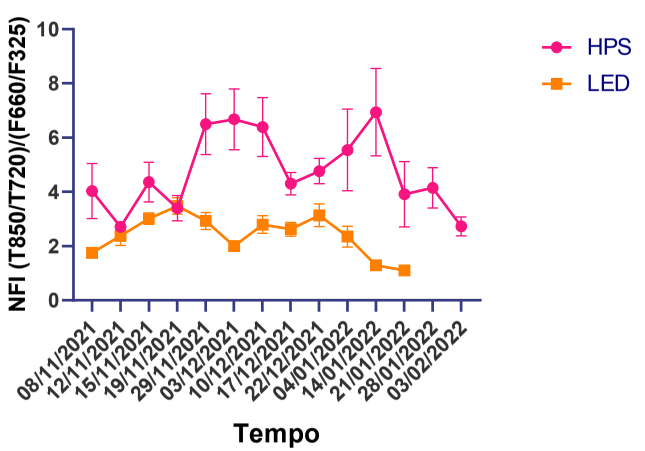
2022 - Analisi in vivo-Contenuto di azoto fogliare

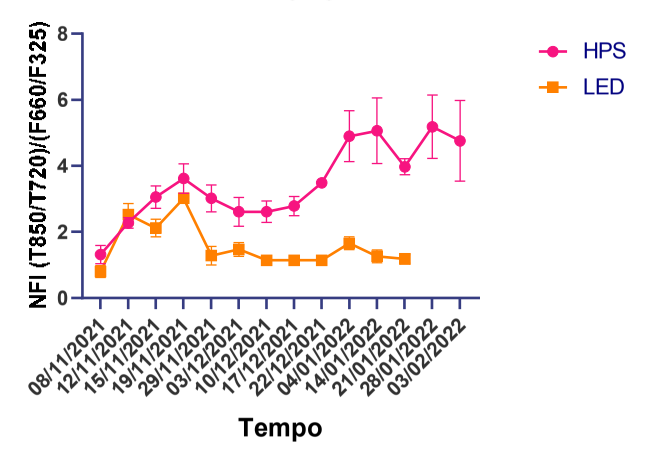




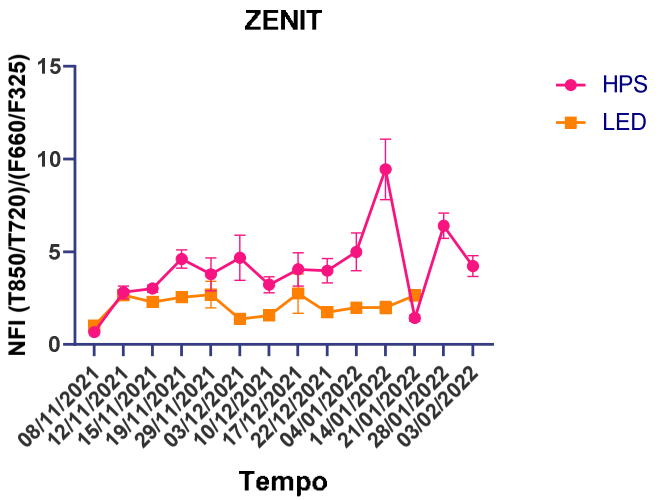


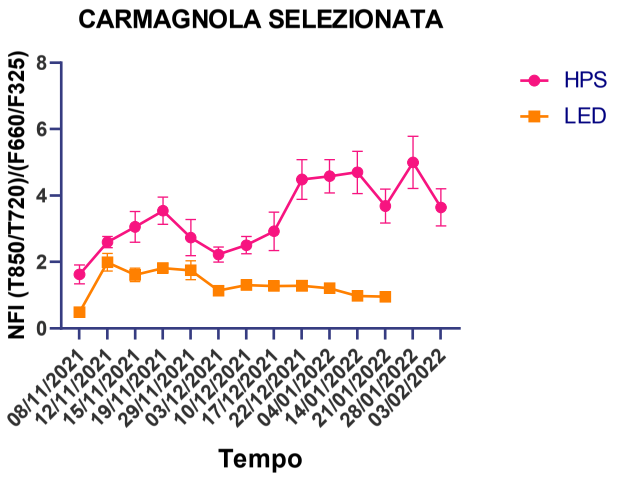


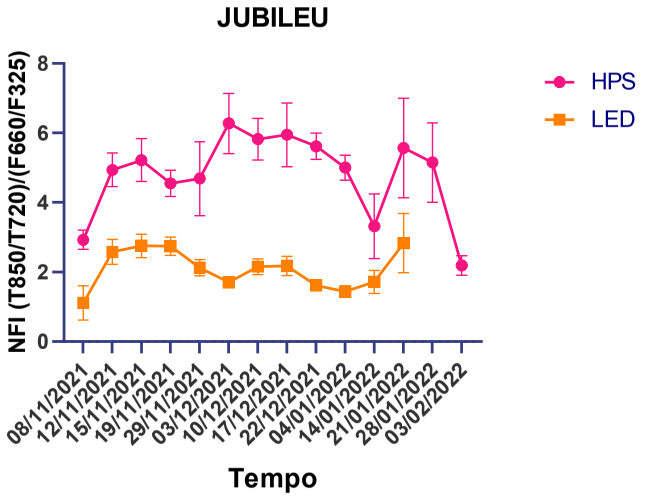




2022 - Analisi in vivo-Contenuto di azoto fogliare

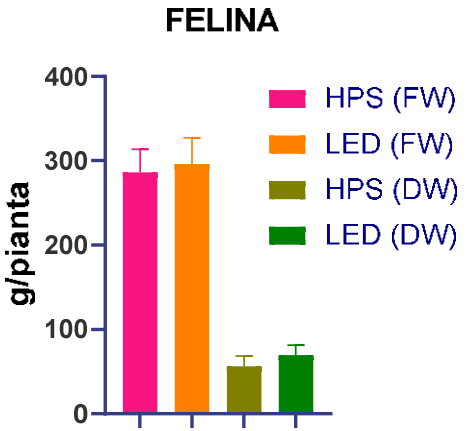


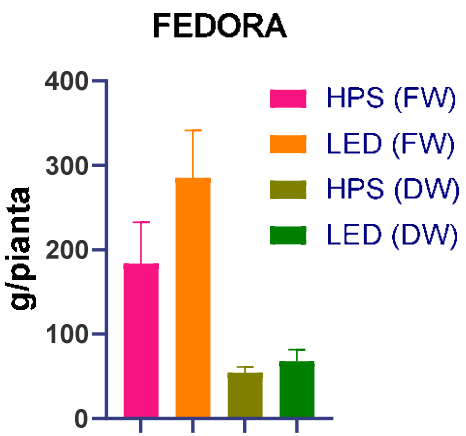


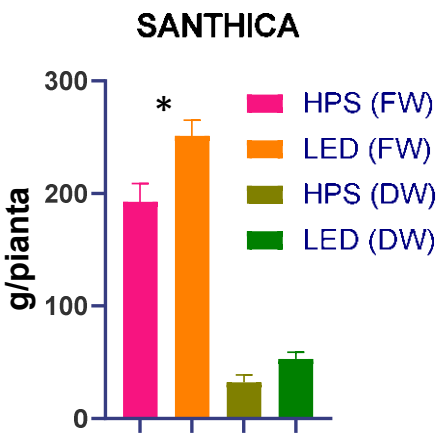


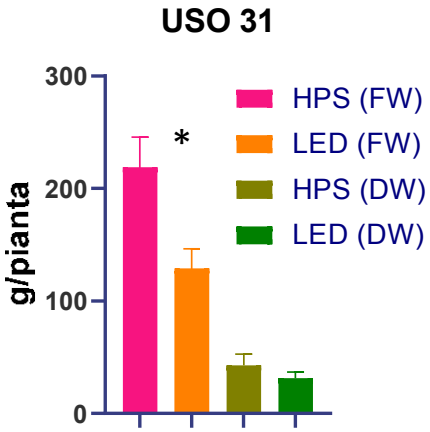
LE TESI SOTTO HPS MOSTRANO VALORI COSTANTEMENTE SUPERIORI ALLE TESI SOTTO LED
MINORE UTILIZZO DELL'AZOTO -> MINORE FOTOSINTESI / MINORE BIOMASSA

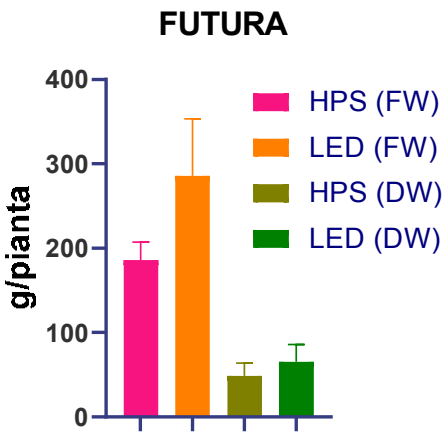
2022 - Resa biomassa fresca (FW) e secca (DW)

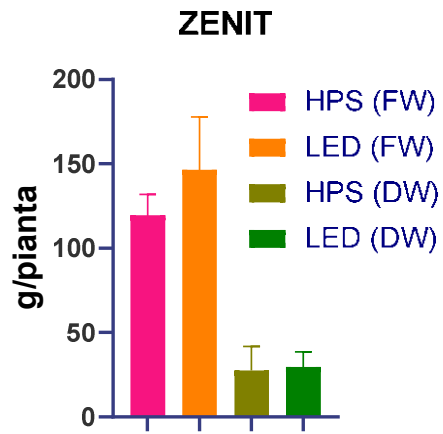




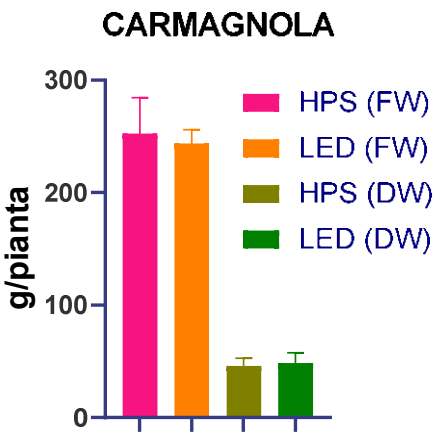


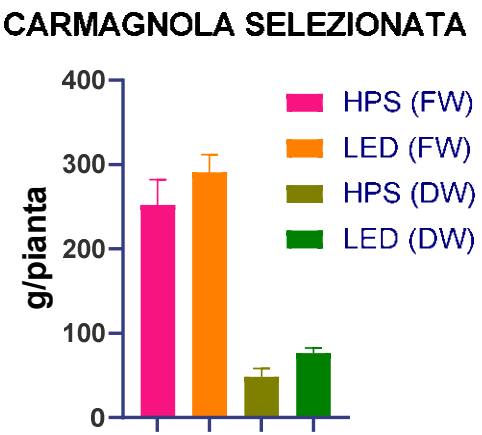


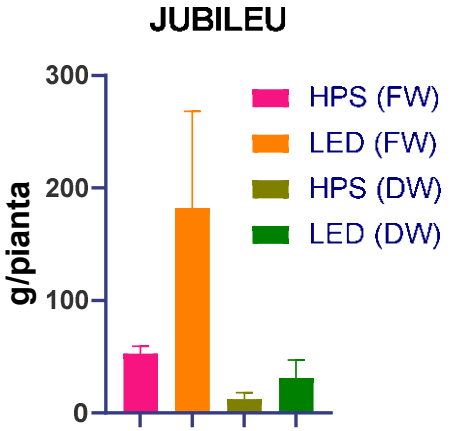




2022 - Resa biomassa fresca (FW) e secca (DW)

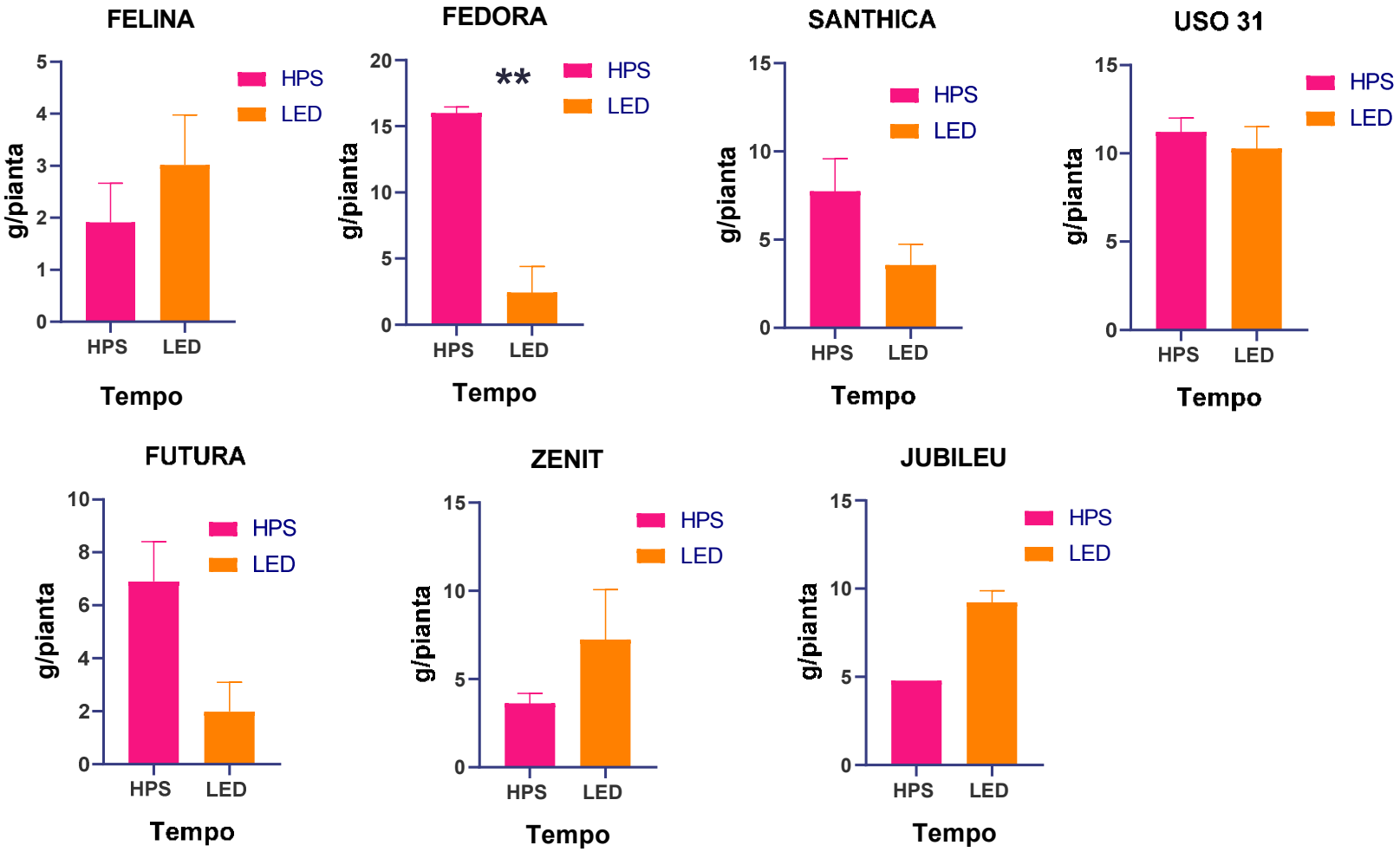






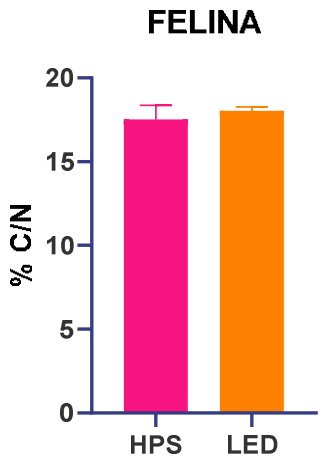
DIFFERENZE SIGNIFICATIVE SOLO IN PESO FRESCO PER SANTHICA E USO 31
JUBILEU ALTA VARIABILITÀ SOTTO LED

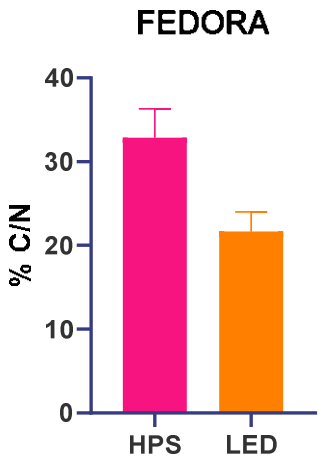
2022 - Resa semi

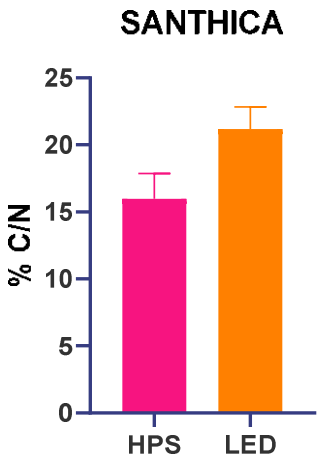


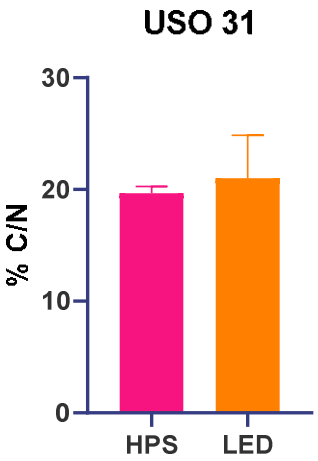
ANDAMENTI NON UNIVOCI E DIFFERENZE SIGNIFICATIVE SOLO PER FEDORA

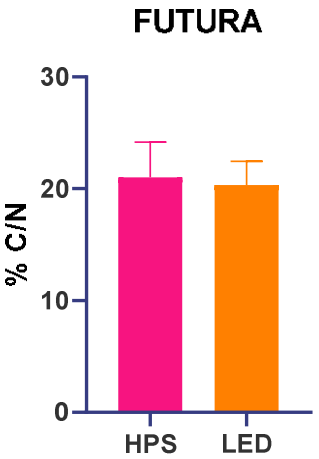
2022 - Analisi distruttive - Rapporto C/N

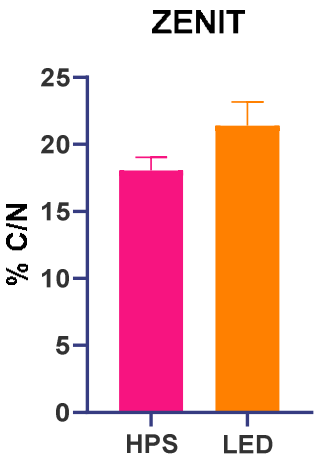




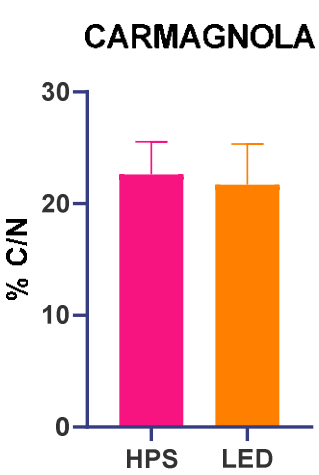


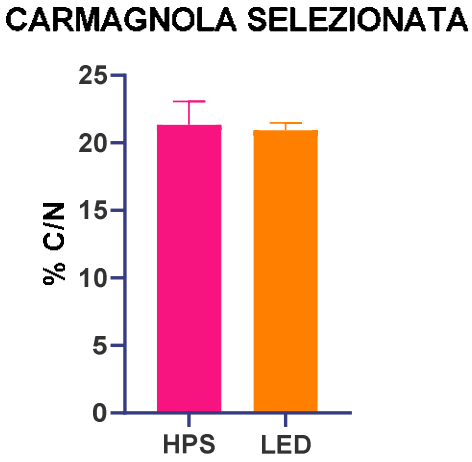


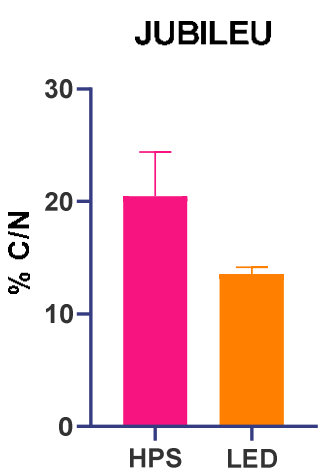




2022 - Analisi distruttive-Rapporto C/N

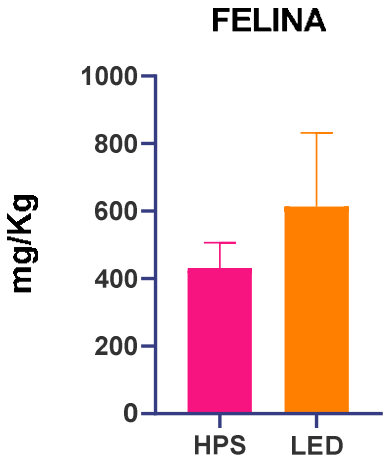


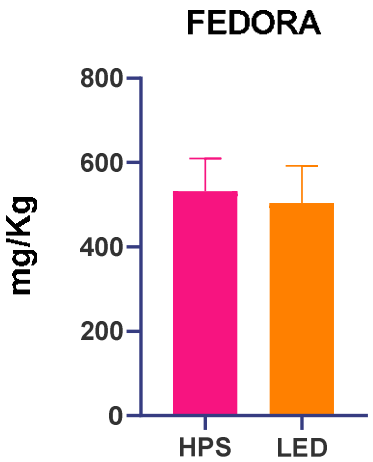


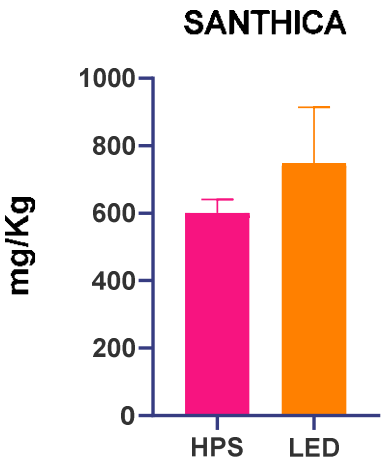


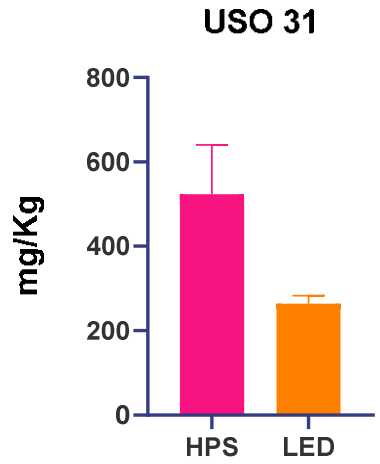
ANDAMENTI NON UNIVOCI E NESSUNA DIFFERENZA SIGNIFICATIVA

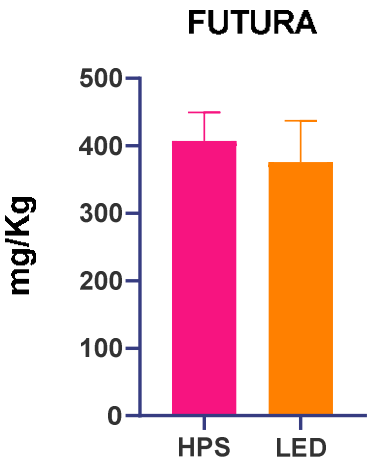
2022 - Analisi distruttive - Contenuto di Nitrati

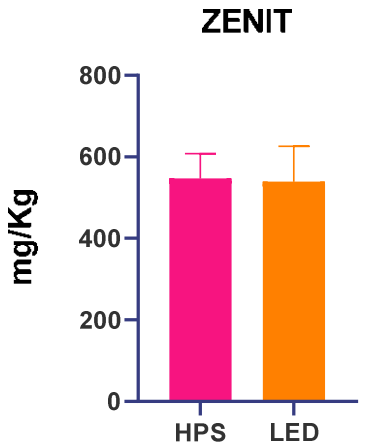




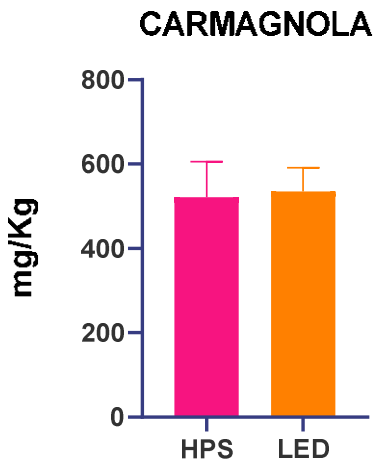


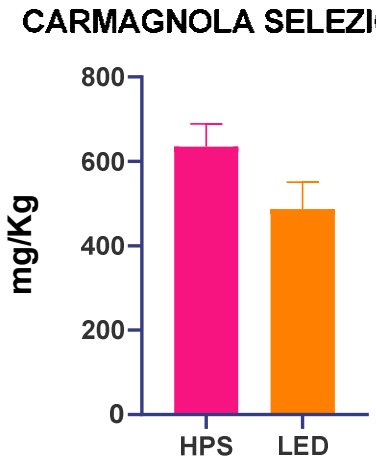


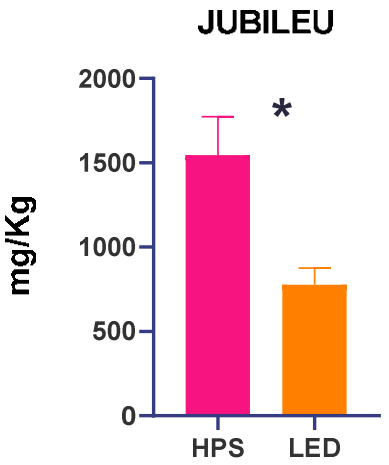




2022 - Analisi distruttive - Contenuto di Nitrati

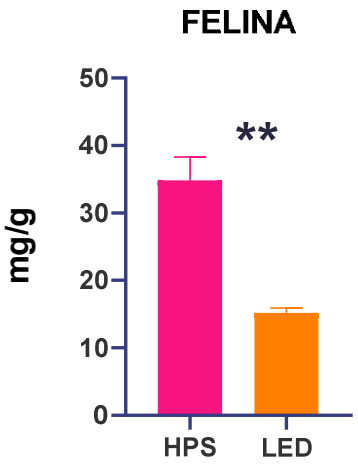


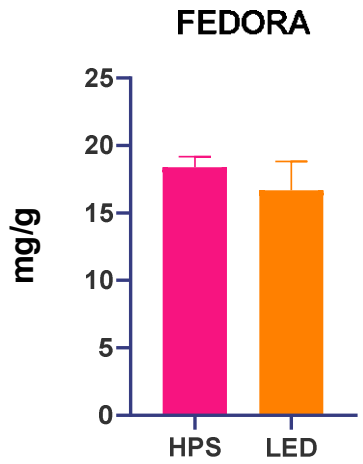


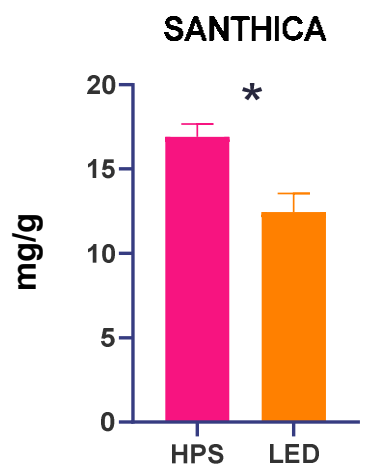


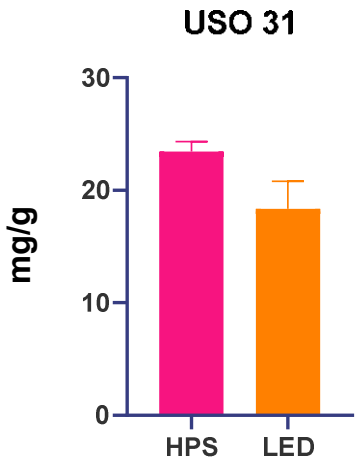
ANDAMENTI NON UNIVOCI E DIFFERENZA SIGNIFICATIVA SOLO PER JUBILEU

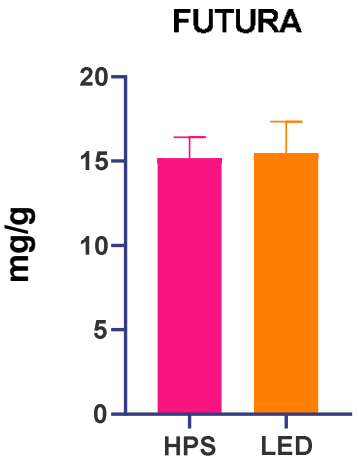
2022 - Analisi distruttive - Contenuto di Zuccheri Totali

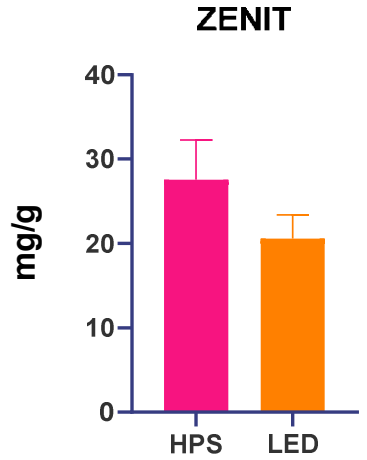




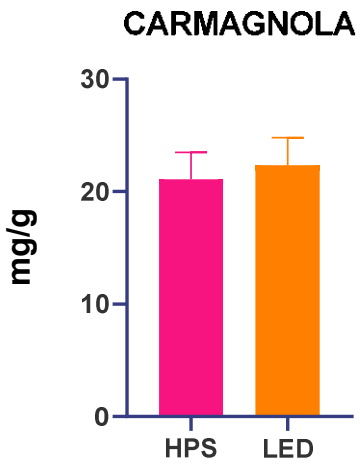


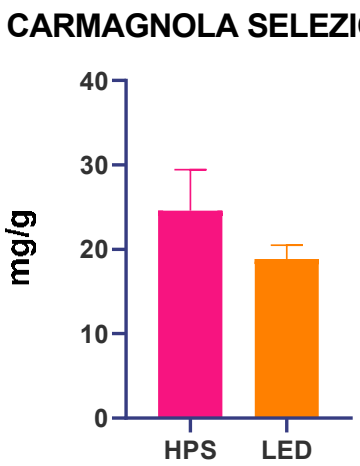


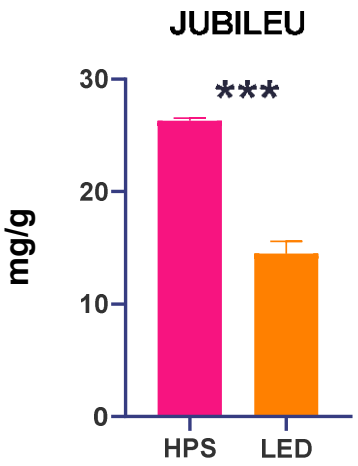




2022 - Analisi distruttive - Contenuto di Zuccheri Totali







DIFFERENZE SIGNIFICATIVE SOLO PER JUBILEU, CONTENUTO SUPERIORE IN TESI HPS

CONCLUSIONI

LA MAGGIORE SPINTA RADIATIVA DELLE TESI SOTTO LAMPADE LED HA DETERMINATO:

- **CRESCITA PIÙ RAPIDA**
- **MAGGIORE ALLUNGAMENTO DEGLI INTERNODI**
- **CONTENUTO AZOTO FOGLIARE INFERIORE**

NON SI COLGONO DIFFERENZE SIGNIFICIATIVE PER:

- **CONTENUTO DI CLOROFILLA**
- **RESA BIOMASSA FRESCA**
- **RESA BIOMASSA SECCA**
- **RESA IN SEME**
- **RAPPORTO C/N**
- **NITRATI**
- **ZUCCHERI TOTALI**

LE LAMPADE LED PERMETTONO IL RAGGIUNGIMENTO DEL MEDESIMO LIVELLO PRODUTTIVO DI BIOMASSA IN TEMPI MINORI

SI RICORDA CHE LE VARIETÀ STUDIATE SONO STATE SELEZIONATE PER LA PRODUZIONE DI FIBRA
LA PRODUZIONE DI SEME SI GIOVEREBBE DI OPPORTUNA ATTIVITÀ DI SELEZIONE

PROSSIME ATTIVITÀ

MODELLO FENOLOGICO CHE TENGA IN CONSIDERAZIONE LE FORZANTI TERMICHE RADIATIVE

SVILUPPO CONCENTTUALE DI UN MODELLO DI ACCUMULO DI BIOMASSA PER IL PIENO CAMPO E PER LA SERRA

LAVORO SVOLTO IN COLLABORAZIONE CON

DAVIDE GUFFANTI, FRANCESCO ELIA FLORIO E ANTONIO FERRANTE

GRAZIE PER L'ATTENZIONE

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