ID 1736 - EVALUATION OF LOW-NICOTINE TOBACCO CULTIVARS AND AGRONOMIC PRODUCTION PRACTICES BY NON-DESTRUCTIVE PHOTONIC SENSING

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INTRODUCTION

FDA & WHO

low nicotine levels in cigarettes
to reduce overall addiction

low nicotine cv and agronomic practices
to reduce nicotine accumulation
in tobacco leaf

open questions
for quality and smoke flavor characteristics

AIM OF THE PROJECT

Application of a non-destructive photonic sensing method to the proximal detection of Tobacco N status

+ correlation with leaf nicotine content (%) at harvest
+ eventually tune up varietal choice and agronomic techniques to the low-nicotine target

Studies involved:

- *CORESTA Collaborative Study of Low Nicotine Tobacco Agronomic Production Practices (LNTP);*
- *RTK Umbria 2.0 Project: prototyping an RTK network for innovative technological applications, automated cropping processes and information management for precision farming.*

THE VARIETAL TEST

FAT's experimental plot at Lerchi, Città di Castello, PG (43°28'19.9''N 12°13'04.2''E). 2020/07/10

- Location: Fattoria Autonoma Tabacchi (FAT - Città di Castello [PG], Italy)

- Virginia Bright cv: **SLV**, **ITB697**, **MS K326 LA**, **K326**

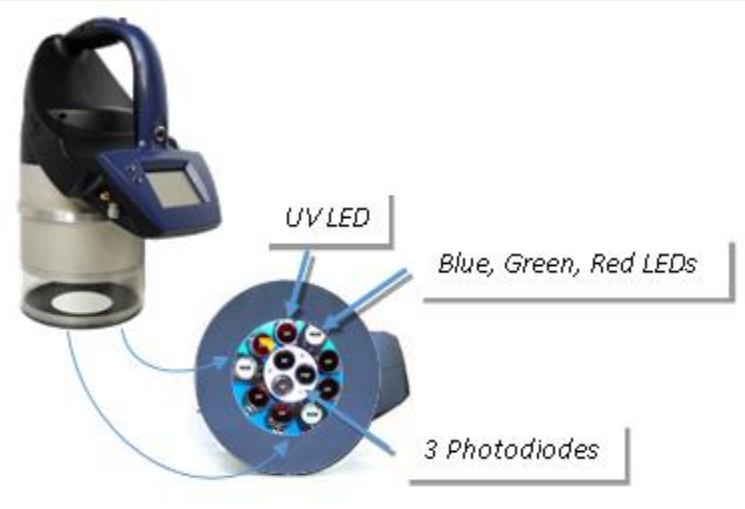
- Management:

Local **B**est **P**ractices
LBP = standard nitrogen fertilization [115 kg/ha N] and topping; planting distance 115 x 37 cm;
Low-**N**icotine **M**anagement
LMN = reduced N [55 kg/ha N] and no topping; reduced planting distance 115 x 26.5 cm

- Transplanting: May 16, 2020

- Topping: 2020/07/30 (PVH2310, ITB697, MS K326 LA) and 2020/08/08 (K326).

THE IN FIELD PHOTONIC SENSING METHOD



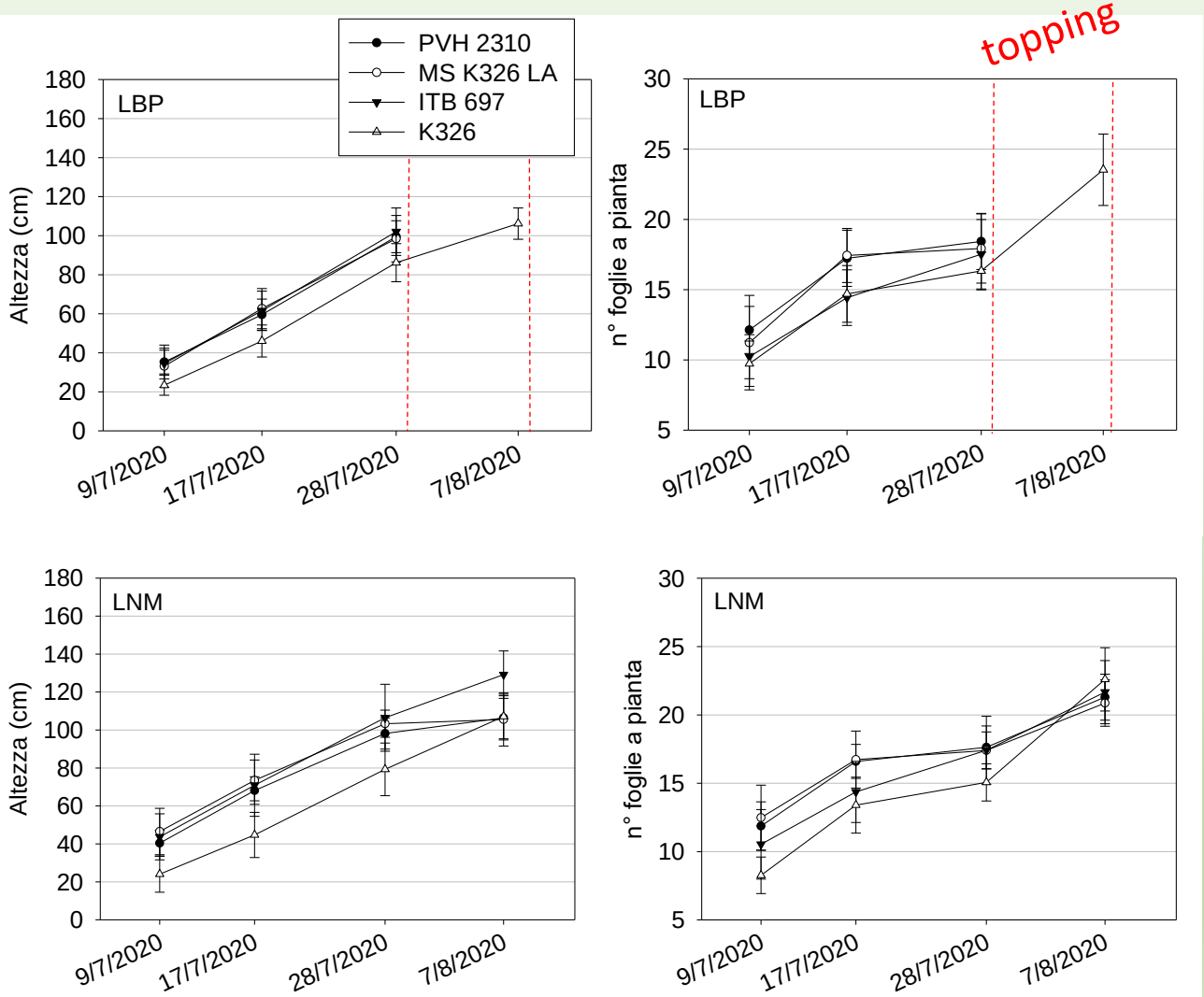
Lateral and frontal view of the optical sensor.
In the external part: 6 UV LEDs emitting 375nm, and 3 Blue-Green-Red LEDs emitting at 470nm, 515nm, and 630nm excitation light, respectively.
In the central part: 3 detectors for yellow (c.ca 590nm) red (c.ca 685nm) and far red (c.ca 735nm)

The portable fluorescence sensor provided indices of leaf:

- chlorophyll (SFR_R)
- flavonols (FLAV)
- nitrogen (Nitrogen Balance Index, NBI=CHL/FLAV)

The upper sun-exposed side of a single leaf for each plant was measured in the field at the stage of the maximal plant N assimilation, and before harvest.

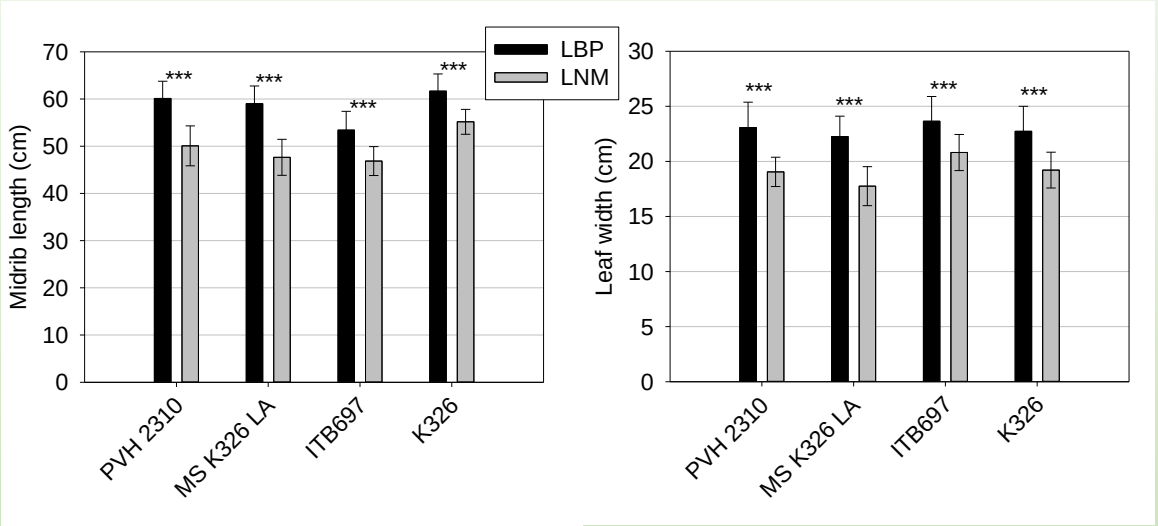
RESULTS FOR PLANT GROWTH

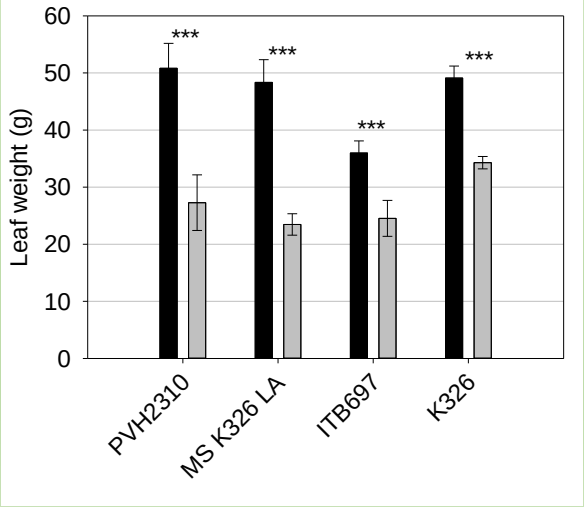


- Before LBP topping date, plant growth results were similar;
- Only exception: K326 had a lower growth

LBP	First harvest date
PVH 2310	August 26, 2020
MS K326 LA	August 26, 2020
ITB 697	August 10, 2020
K326	August 26, 2020
LMN	
PVH 2310	August 10,2020
MS K326 LA	August 19, 2020
ITB 697	August 10,2020
K326	August 19, 2020

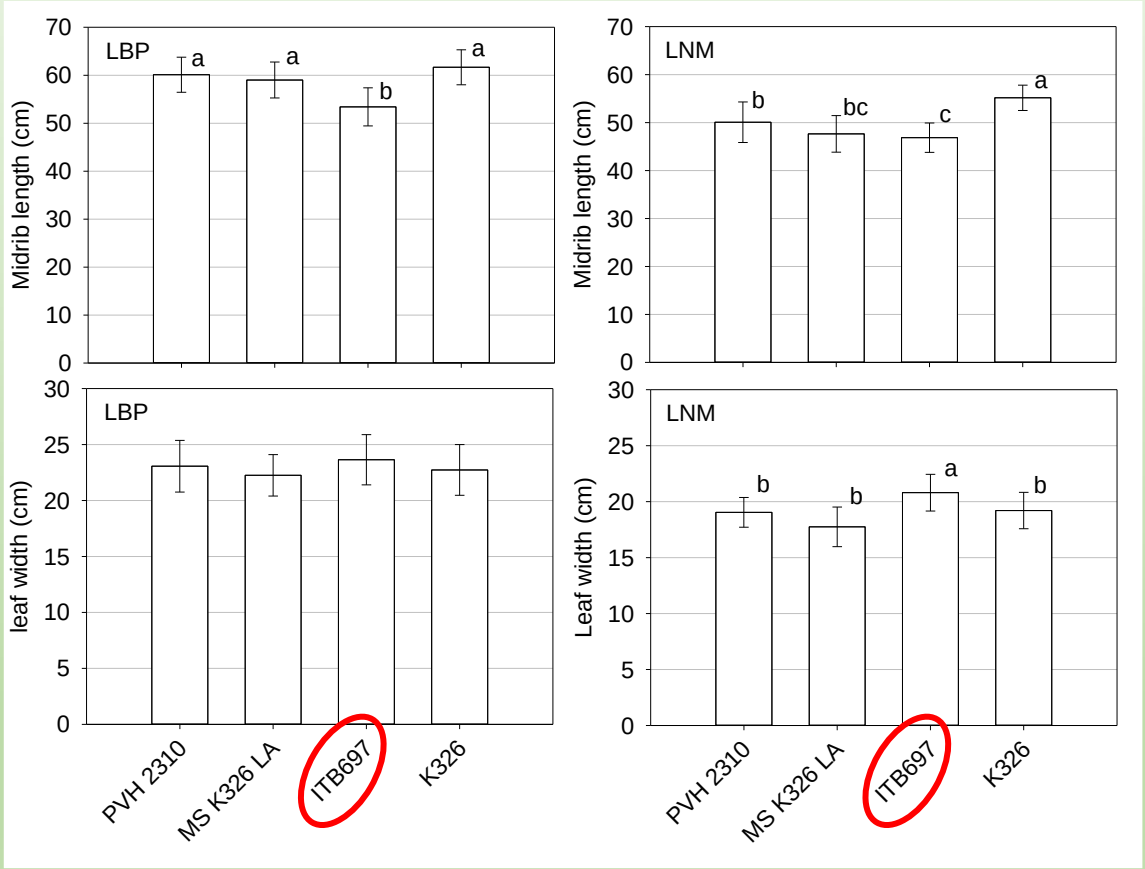
LEAF PARAMETERS 15 days after LBP topping date



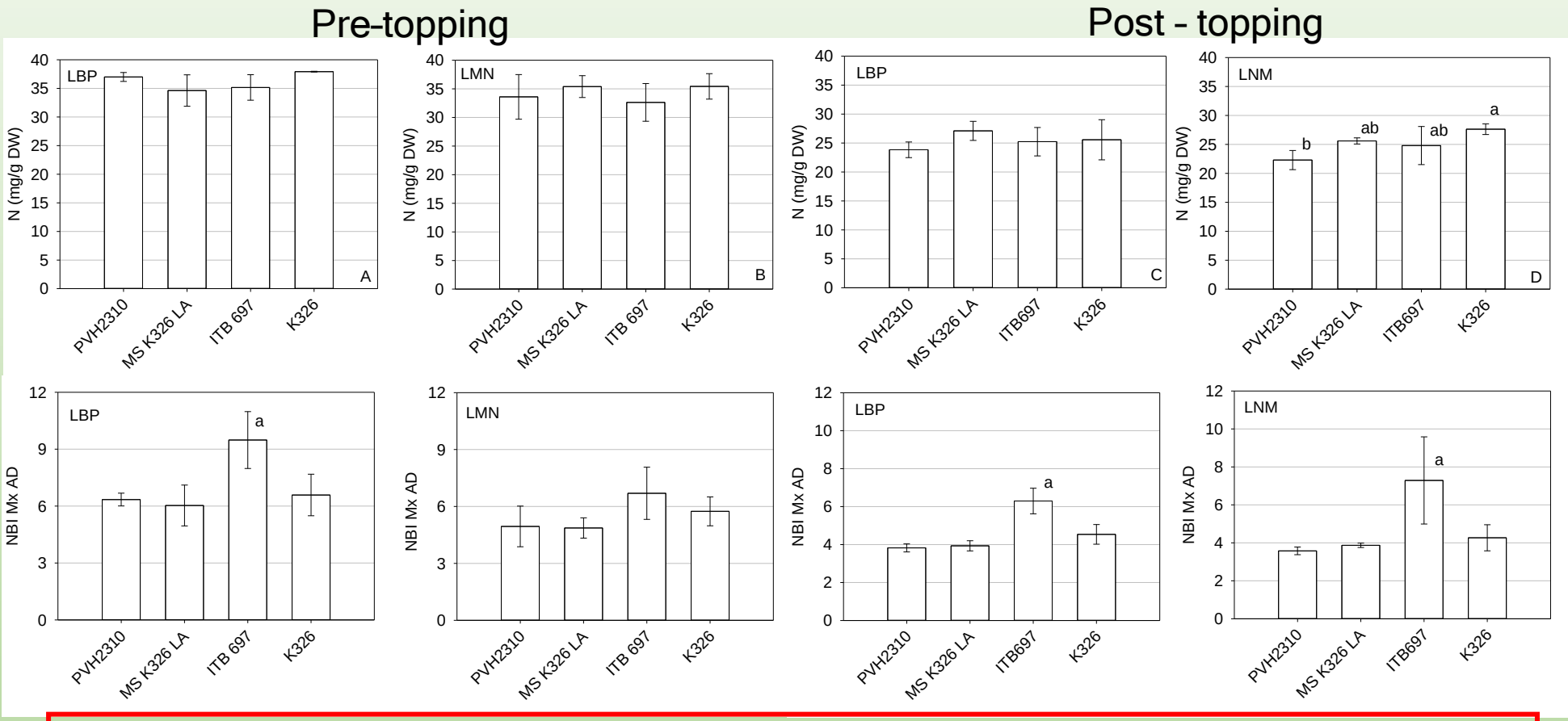


All varieties under LNM showed reduced leaf area & weight

ITB697 showed shorter and larger leaves



MANAGEMENT AND VARIETY EFFECTS ON LEAF N CONTENT DETERMINED by DESTRUCTIVE ANALYSES

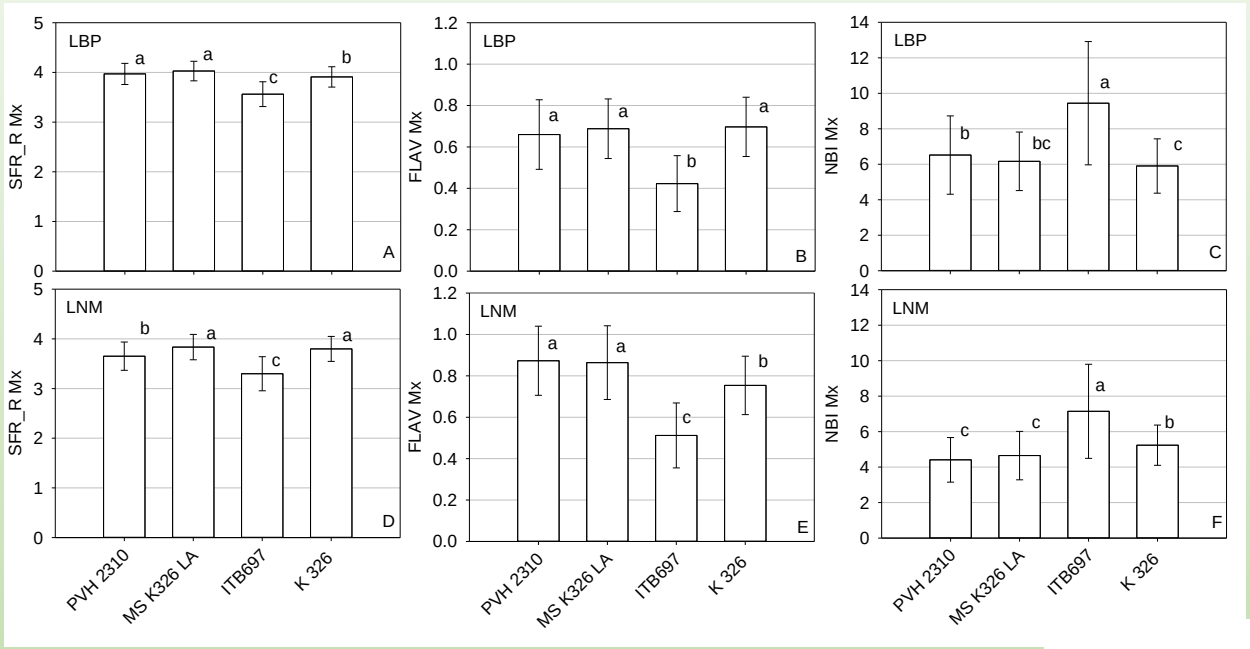


When NBI was detected on the same 5 leaf samples, comparable results were found

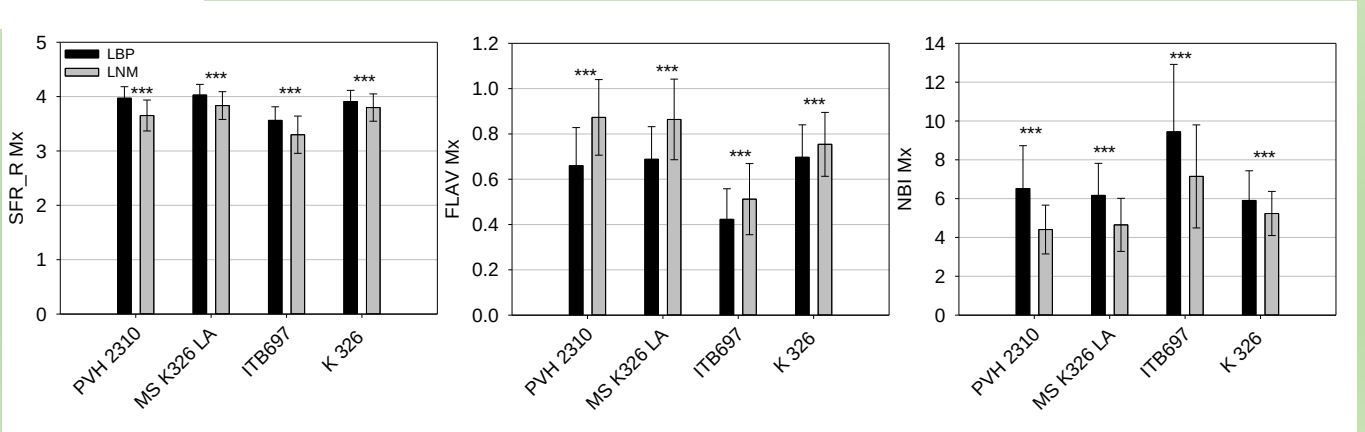
With exception of ITB697. Hypothesis: Larger leaves = shaded leaves = FLAV reduction →

This variety requires a single varietal calibration as it isn't comparable with the others

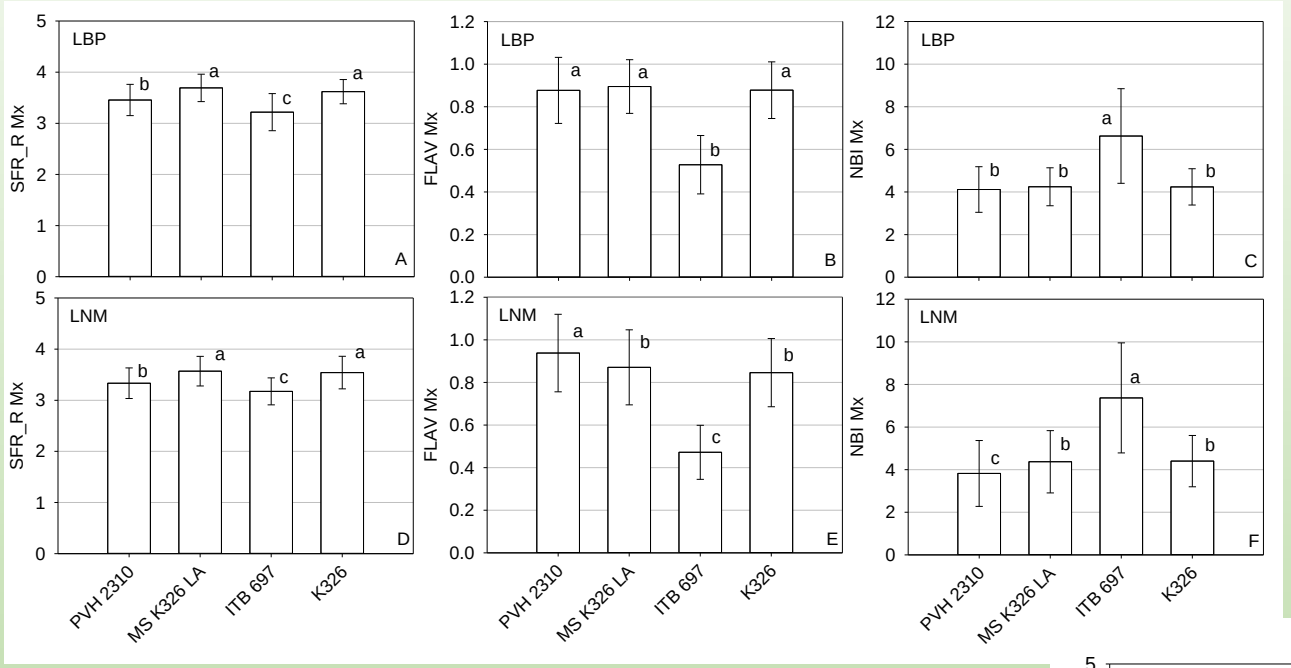
VARIETY AND DIFFERENT MANAGEMENT EFFECTS ON PRE-TOPPING OPTICAL INDICES *(N x Planting distance effect)*



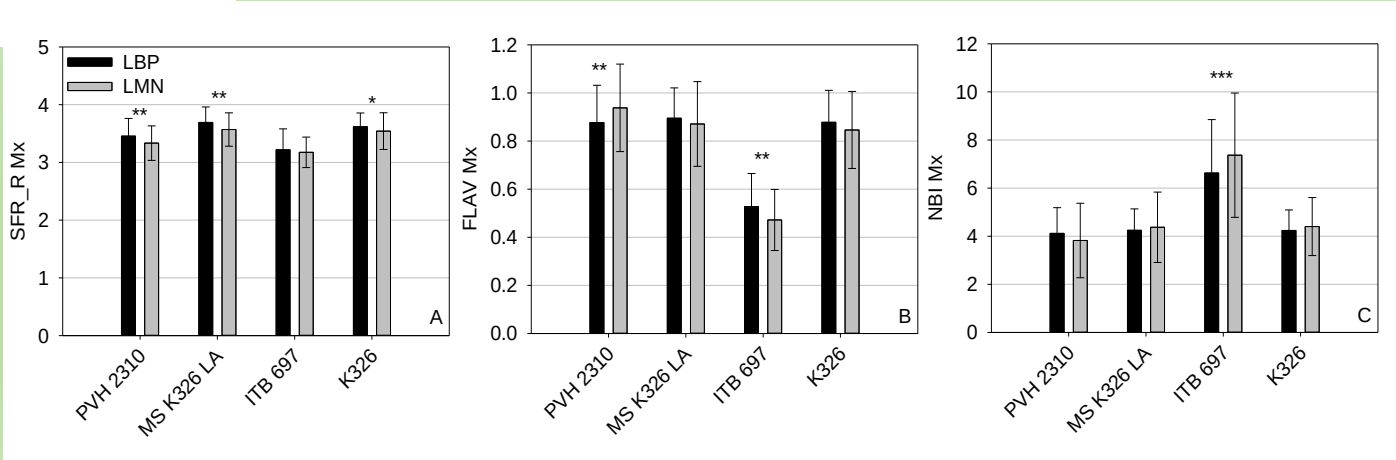
When NBI was detected in the field on at least 50 % plants, significant differences were found among the differently managed varieties for leaf CHL, FLAV and NBI: more representative approach



VARIETY AND DIFFERENT MANAGEMENT EFFECTS ON POST-TOPPING *(LBP)* OPTICAL INDICES



Significant variability in this phase can be influenced by senescence process, with chlorophyll degradation and flavonols accumulation



CONCLUSIONS

DUE TO LATE SEASON, AND COVID-19 LAB RUNNING RULES, WHICH HAVE SLOWED DOWN ANALYTICAL TASKS, TOBACCO YIELD AND QUALITY DATA (INCLUDED NICOTINE) WILL BE PRESENTED IN THE MANUSCRIPT UNDER COMPLETION.

HOWEVER, THESE PRELIMINARY DATA INDICATE THE USEFULNESS TO INTEGRATE A PHOTONIC SENSING TECHNOLOGY IN TOBACCO CROP TO IDENTIFY NEW APPRECIABLE LOW-NICOTINE VARIETIES AND QUANTIFY THE ACTUAL IMPACT OF AGRONOMIC PRACTICES BY FAST AND HIGH REPRESENTATIVE APPROACH.

THANK YOU FOR THE ATTENTION

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RTK Umbria 2.0: prototyping an RTK network for innovative technological applications, automated cropping processes and information management for precision farming

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