

LOWERING NICOTINE LEVELS IN TOBACCO PRODUCTS

Feasibility and expected impacts on the supply chain

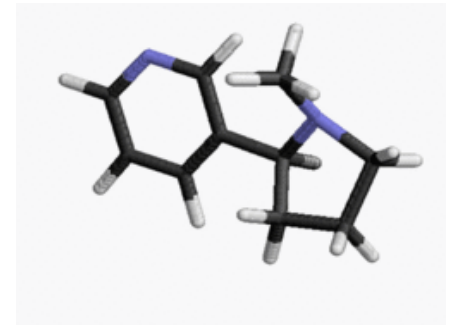
WHO AND FDA POSITIONS



- Tobreg (WHO), October 2015: ***“The maximum nicotine content should be as low as is technically feasible. At present, that level would appear to be 0.4mg nicotine per gram of cigarette tobacco filler”.*** That means **0.04% in raw tobacco.**
- ***“Addressing the addictive levels of nicotine in combustible cigarettes must be part of the FDA’s strategy for addressing the devastating, addiction crisis that is threatening American families”*** said Scott Gottlieb, the FDA commissioner, July 2017.
- ***“FDA is particularly interested in comments about the merits of nicotine levels like 0.3, 0.4, and 0.5mg nicotine/g of tobacco filler, as well as other levels of nicotine”,*** March 2018. That means **0.03 to 0.05% in raw tobacco.**

FUNCTIONAL ROLE IN THE PLANT AND AGRICULTURAL USE

- **Nicotine, synthesized in roots, plays a direct role in defense against pests and pathogens.**
- Progressive gradation; increasing nicotine concentration from lower to upper leaves.
- Nicotine was one of the first insecticides used to control pests in agriculture.



FACTORS AFFECTING THE NICOTINE SYNTHESIS IN TOBACCO PLANT

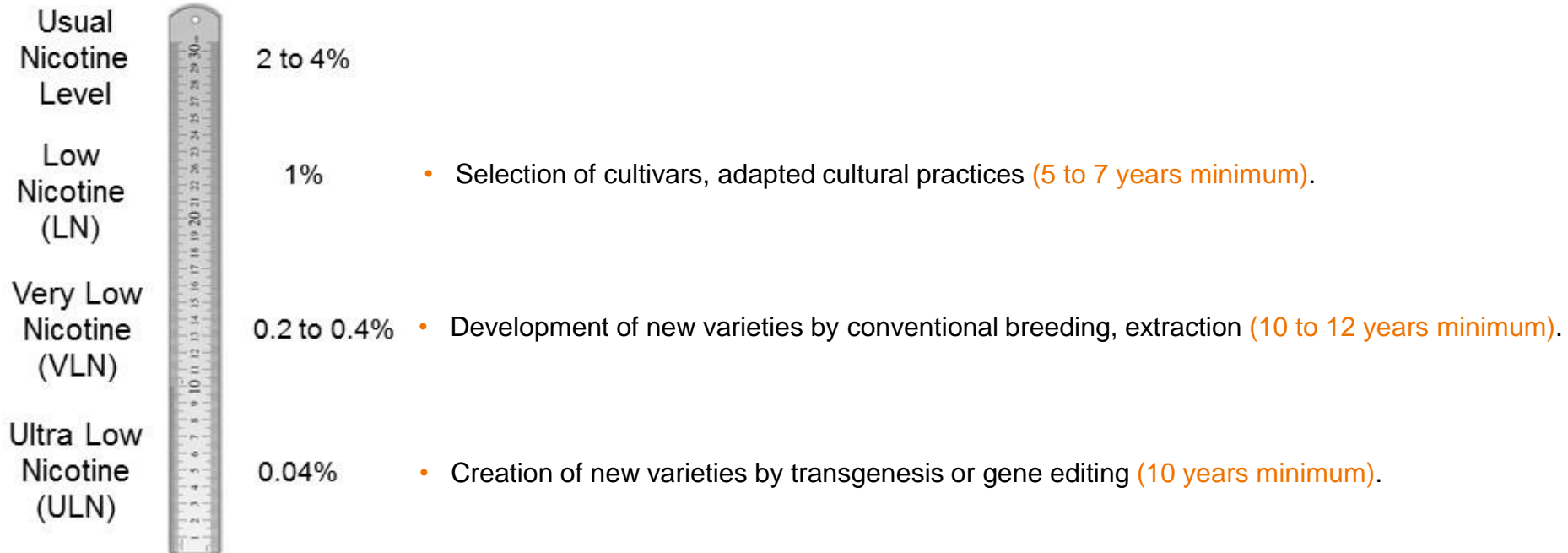


Nicotine level is affected by genetics, environmental conditions and cultural practices

- Plant density
- Light
- Soil temperature
- Nitrogen fertilizer
- Topping height
- Time between topping and harvest.



FEASIBILITY TO LOWER NICOTINE CONTENT



POSSIBLE SOLUTIONS, PROS AND CONS



| Solutions | Reduction | Pros | Cons |
|---|----------------------|--|---|
| Cultivars selection and cultural practices | -50% (LN) | Varieties available Easy to implement | CPA application increase, Low yield (Trials ongoing), Taste change, acceptability by smokers? |
| Conventional breeding and cultural practices | -80 to 90% (VLN) | Technically feasible | CPA application increase, Low yield, Taste change. |
| Extraction | Up to -80%? (VLN) | Technology available | Cost (factories), Destructive, product is different → processing issues, Taste change & residues, Not industrially feasible. |
| Biotechnologies | -98 to 99% (ULN) | Technically feasible in some years | Patents on genes and technology, Regulatory authorization needed, Public opinion is anti-GMO in Europe, Impact on trading, CPA application increase, Yield?, Bad quality, Practicability unknown . |

EXPECTED IMPACTS ON THE SUPPLY CHAIN



| On | Impact |
|----------------|---|
| Growers | Use of soils poor in nitrogen, CPA application increase → environmental residues, Lower production yields, Sustainability, Opposition against GMOs. |
| Leaf suppliers | Increase demand on lower stalks, Waste: Mid and upper stalk leaf not usable in the legal market. |
| Manufacturers | Public opposition against GMOs in general, Products of poor quality, Lower demand on legal products, Expansion of illicit trade (T. Verron <i>et al.</i> , CORESTA, 2017). |

CONCLUSION



- Low Nicotine (50% reduction) is feasible and practical: with a 5-7 year program, 1% nicotine in leaf could be achieved.
- However, lowering nicotine may undermine sustainability and prove counterproductive: significant risk of increased illicit trade.
- The supply chain could be exposed globally to massive impacts.
- Feasibility is **not** the same as practicability.

Thank you.