PERFOMANCE AND ADAPTABILITY EVALUATION OF DDV 10, DDV 23, DDV 42 AND DDV 43 FOR REGISTARION AND RELEASE IN TANZANIA

VARIETY DESCRIPTION

Name of Variety: DDV 10

1 (a) Name of crop: - **Tobacco**
(b) Botanical name: - ***Nicotianatabacum***
(c) Family name: ***Solanaceae***
(d) Chromosome number: **48**
(e) Mode of pollination: **Cross-pollinated (male-sterile hybrid)**

2 (a) Proposed release name: **DDV 10**
(b) Names under which tested: **DDV 10**
(c) Agency responsible for development: **Dandeva Seed Services (T) Ltd**
(d) Cultivar pedigree: **Male-sterile MT 55 x KS51**

3 (a) Proposed area of release: **All tobacco growing areas**
(b) Proposed elevation: **500 – 1950 metres above sea level**
(c) Agency responsible for breeder seed: **Dandeva Seed Services (T) Ltd**
(d) Agency responsible for maintenance: **Dandeva Seed Services (T) Ltd**

4 Points of merit:
- **Resistant to root-knot nematode *Meloidogyne incognita* and *javanica***
- **Higher percentage of lamina /midrib ratio**
- **Slow ripening of leaves**

Name of Variety: DDV 23

1 (a) Name of crop: **Tobacco**
(b) Botanical name: ***Nicotianatabacum***
(c) Family name: ***Solanaceae***
(d) Chromosome number: **48**
(e) Mode of pollination: **Cross-pollinated (male-sterile hybrid)**

2 (a) Proposed release name: **DDV 23**
(b) Names under which tested: **DDV 33**
(c) Agency responsible for development: **Dandeva Seed Services (T) Ltd**
(d) Cultivar pedigree: **Male-sterile MXZ x K 56**

3 (a) Proposed area of release: **All tobacco growing areas**
(b) Proposed elevation: **500 – 1950 metres above sea level**

(c) Agency responsible for breeder seed: **Dandeva Seed Services (T) Ltd**
(d) Agency responsible for maintenance: **Dandeva Seed Services (T) Ltd**

4 Points of merit:

- **Resistant to root-knot nematode *Meloidogyne incognita* and *javanica***
- **Higher percentage of lamina /midrib ratio**
- **Slow ripening of leaves**

Name of Variety: DDV 42

1 (a) Name of crop: **Tobacco**
(b) Botanical name: ***Nicotianatabacum***
(c) Family name: ***Solanaceae***
(d) Chromosome number: **48**
(e) Mode of pollination: **Cross-pollinated (male-sterile hybrid)**

2 (a) Proposed release name: **DDV 42**
(b) Names under which tested: **DDV 26**
(c) Agency responsible for development: **Dandeva Seed Services (T) Ltd**
(d) Cultivar pedigree: **Male-sterile MT R26 x KS51**

3 (a) Proposed area of release: **All tobacco growing areas**
(b) Proposed elevation: **500 – 1950 metres above sea level**
(c) Agency responsible for breeder seed: **Dandeva Seed Services (T) Ltd**
(d) Agency responsible for maintenance: **Dandeva Seed Services (T) Ltd**

4. Points of merit:

- **Resistant to root-knot nematode *Meloidogyne incognita* and *javanica***
- **Higher percentage of lamina /midrib ratio**
- **Slow ripening of leaves**

Name of Variety: DDV 43

1 (a) Name of crop: **Tobacco**
(b) Botanical name: ***Nicotianatabacum***
(c) Family name: ***Solanaceae***
(d) Chromosome number: **48**
(e) Mode of pollination: **Cross-pollinated (male-sterile hybrid)**

2 (a) Proposed release name: **DDV 43**
(b) Names under which tested: **DDV 43**
(c) Agency responsible for development: **Dandeva Seed Services (T) Ltd**
(d) Cultivar pedigree: **Male-sterile MT SX x K 326**

3 (a) Proposed area of release: **All tobacco growing areas**
(b) Proposed elevation: - 500 **– 1950 metres above sea level**

(c) Agency responsible for breeder seed: **Dandeva Seed Services (T) Ltd**
(d) Agency responsible for maintenance: **Dandeva Seed Services (T) Ltd**

4. Points of merit:
    - **Resistant to root-knot nematode *Meloidogyne incognita* and *javanica***
    - **Higher percentage of lamina /midrib ratio**
    - **Slow ripening of leaves**

Introduction/background information

Flue-cured tobacco in Tanzania is traditionally grown in 2 growing zones namely: Western Tobacco growing Zone (WTGZ) and Southern Tobacco Growing Zone (STGZ). The commonly grown tobacco variety in the country is K 326 that has been grown for almost 13 years. K 326 is originated from America and it has got no resistance to the root knot nematode (*Meloidogyne javanica*) that is a major problem in tobacco growing areas in Sub Saharan Africa.
Due to lack of tolerance/resistance to the nematodes, Tobacco Research Program decided to look for alternative varieties in order to combat this problem. Therefore the Tobacco Research Institute of Tanzania (TORITA) introduced six varieties from Zambia that could be tolerant/resistant to root knot nematodes. After screening in 2010 two varieties were discontinued remaining with 4 varieties; DDV 10, DDV 23, DDV 42 and DDV 43 which were advanced to multi-location trials.

Purpose for developing these varieties

These varieties were mainly developed for tobacco production in slow, medium and fast growing conditions particularly where alternaria (*Alternaria alternata*), black shank (*Phytophthora parasitica*), angular leaf spot (*Pseudomonas syringae*) or rootknot nematodes are a problem. They are moderately slow ripening hybrids and are of benefit to tobacco growers as a management tool as they allow them to maximize the use of their available land and facilities.

After Advanced Yield Trials (AYT) and on farm assessment, the results indicated that the four varieties were resistant to the rootknot nematodes *Meloidogyne incognita* and *javanica*, had higher lamina percentages, were slower ripening and generally yielded higher than the commonly used variety K 326. TORITA therefore forwarded these four varieties to Tanzania Official Seed Certification Institute (TOSCI) for release consideration.

Methodology

In 2008 six flue-cured (FCV) tobacco varieties were introduced in the country from Zambia. In 2008 and 2009 these varieties were evaluated in preliminary trials at Tumbi Tobacco Research Institute for nematode resistance, yield and transplanting survival rate. Therefore, among the six, two varieties were discontinued and the remaining four varieties were advanced to multi-location testing to evaluate adaptation to different tobacco growing areas.

The four (4) varieties namely DDV 10, DDV 23, DDV 42 and DDV 43 were tested on Urambo Seed Farm (Urambo District), Tumbi Tobacco Research Institute (Tabora) and Mtanila – Chunya

in the 2010/11 and 2011/12 seasons. These varieties were compared with K 326 that is commonly used by farmers. The experimental design used was the Randomized Complete Block Design (RCBD) with four replications.
The following parameters were used for the assessment

- Saleable yield
- High grade index
- Stem/lamina ratio
- Root knot nematode gall count
- Reaping interval
- Disease scores

Saleable yield
This is the dry leaf weight obtained after curing and graded which has been brought to the market. It is measured as kilogram dry weight per hectare.
Grade index
This is an indicator of the measured quality of cured leaf as determined by the classification of the grades; the higher the grade index the higher the quality of the leaf.
Midrib/Lamina ratio
This is the ratio of lamina to midrib of a cured leaf presented as a percentage. A dry leaf is stripped to separate lamina from the midrib and each sample is weighed separately to obtain the ratio.
Root knot nematode galls assessment
This is obtained from assessing the severity of galls in the root structure of the plant and ranges from 0 (no galls) to 8 (severe galling).
Reaping intervals
This is the period between two successive harvestings of the matured leaf and is normally measured by number of days between the two harvests.
Disease scores
The following diseases were scored, Alternaria (*Alternaria alternata*), Granville wilt and angular leaf spot (*Pseudomonas syringae*). The scales used for scoring the diseases are indicated below.
With the exception of all disease and root knot assessments, all data was subjected to analysis of variance (ANOVA) and means were separated using Duncan multiple range test (DMRT).

ADVANCED YIELD TRIAL (AYT)

Results and discussion
The four DDV varieties were compared with the control K 326 in disease trials in which they were assessed for resistance to frogeye (*Cercospora nicotianae*), alternaria, angular leaf spot and the root knot nematode (see tables 3 to 6). The DDV hybrids were found to be more resistant to the aforementioned diseases and pest than K 326. Frogeye is a desirable trait with respect to quality; there was a similar incidence of the fungal disease recorded in each of the entries inclusive of the control.

When compared with the four DDV hybrids, K 326 was inclined to produce a narrower and longer leaf, as is indicated by the comparatively lower lamina percentages recorded at all four sites (table 2). The DDV varieties had comparatively higher lamina percentages compared to K

326; such a characteristic namely a high lamina: midrib ratio is desirable trait from both a grower and manufacturer perspective.DDV 10, 23, 42 and 43 were slower ripening than K 326; the trend towards a higher saleable yield was a reflection of this characteristic (table 1) as a slow ripening characteristic leads to growers being able to reap and cure the leaf with reduced losses in the field

Table 1: Saleable Yield (kg/ha)

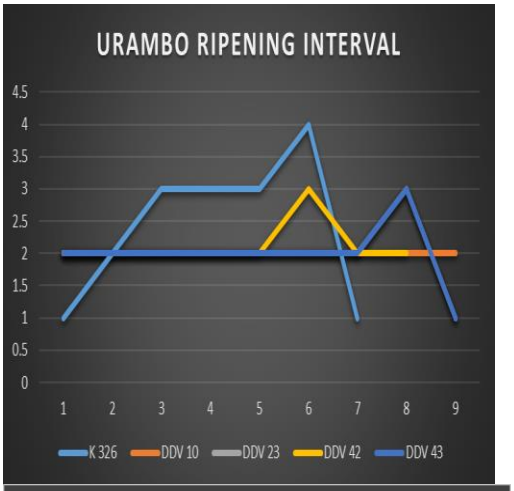
No	Variety	2010 – 11			2011 – 12		
		URAMBO	TUMBI	CHUNYA	URAMBO	TUMBI	CHUNYA
1	K 326	2014.65b	2032.95	1915.8b	1793	1849.18	1882.4bc
2	DDV 10	2325.32a	2267.71	2140.88ab	1613	2584.3	2027.19bc
3	DDV 23	2165.55ab	2280.21	2226.56a	1641b	2475.79	2233.8a
4	DDV 42	2217.95ab	2346.95	2220.9a	1881	2149.37	2267.18a
5	DDV 43	2405.16a	2402.73	2204.58a	1923.2	3324.52	2218.48ab
	Mean	2147.6	2314.14	2141.75	1771.7	2476.63	2125.8
	Lsd	246.4	Ns	285.6	ns	ns	204.8
	cv%	6.12	8.60	8.6	15.91	8.74	6.39

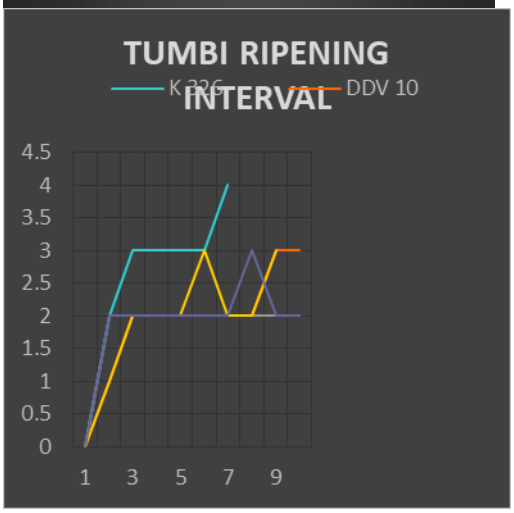
Table 2: Lamina Percentage (2011/12, 2012/13and 2013/14 seasons)

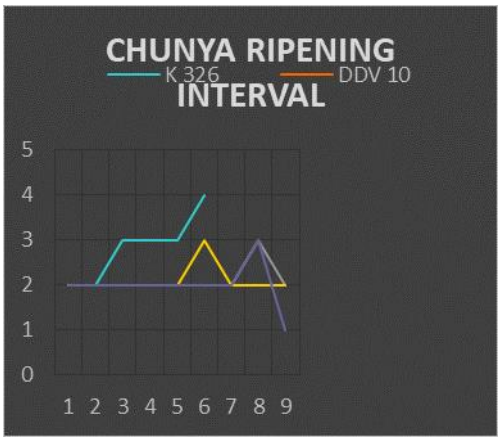
LAMINA PERCENTAGE

No	**Variety**	**2011 - 12**			**2012 - 13**			**2013 – 14**		
		Urambo	**Tumbi**	**Chunya**	**Urambo**	**Tumbi**	**Chunya**	**Urambo**	**Tumbi**	**Chunya**
1	**K 326**	72ab	67c	69c	70ab	71c	71.21b	72.8b	68.5c	73.79c
2	**DDV 10**	71b	72ab	73ab	73ab	76a	74.33a	74.77ab	72.13b	75.93abc
3	**DDV 23**	72ab	73ab	76a	74ab	73ab	73.62a	77.12a	73.64ab	76.86ab
4	**DDV 42**	74a	77a	75a	76a	73ab	75.56a	75.63ab	74.88a	77.25a
5	**DDV 43**	72ab	75b	72b	75b	74b	72.06ab	75.11ab	72.44b	74.65bc
	Mean	**71.96**	72.8	**73**	**73.6**	**73.4**	**73.36**	**75.1**	**72.32**	**75.7**
	lsd	**5.36**	2.6	**6.14**	**3.51**	**4.21**	**8.2**	**5.83**	**2.02**	**1.94**
	cv%	**5.94**	2.34	**6.37**	**3.76**	**4.6**	**7.92**	**5.24**	**2.25**	**2.26**

Figure 1: Ripening Rates of DDV Varieties Compared with K 326







KEY: X-axis shows the harvesting intervals (measured in weeks 1 – 10)
Y-axis shows the number of leaves harvested per week (0 – 4.5)

Table 3: Assessment of Root knot Nematode (*Meloidogyne javanica*) Infection

No	Variety	2010 – 11			2011 – 12		
		URAMBO	TUMBI	CHUNYA	URAMBO	TUMBI	CHUNYA
1	K 326	4	5	3	3	4	3
2	DDV 10	0	0	0	0	0	0
3	DDV 23	0	0	0	0	0	0
4	DDV 42	0	0	0	0	0	0
5	DDV 43	0	0	0	0	0	0

Rootknot Assessment (scores of 0 – 8):

Class	**Degree of Galling**
0	Free of galls
1	Trace infection, less than 5 galls
2	Very slight, 5 to 25 galls
3	Slight, 26 to 100 galls
4	Moderate, numerous galls, mostly discrete
5	Moderate, numerous galls, many coalesced
6	Heavy, numerous galls, mostly coalesced, root growth slightly retarded
7	Very heavy, mass invasion, slight root growth
8	extremely heavy, mass invasion, no root development

Table 4: Assessment of Frogeye Infection

No	Variety	2010 – 11			2011 – 12		
		Urambo	Tumbi	Chunya	Urambo	Tumbi	Chunya
1	K 326	3	2	3	2	3	2
2	DDV 10	1	3	1	3	1	3
3	DDV 23	2	1	3	1	2	2
4	DDV 42	1	2	2	1	3	1
5	DDV 43	2	3	1	2	1	3

Frogeye Assessment (scores of 0-5):

1 = No symptoms
2 = Faint chlorosis
3 = Distinct chlorotic spots
4 = Tiny lesions

5 = Extensive necrosis

Table 5: Assessment of Angular Leaf Spot (ALS) Infection

No	Variety	2010 – 11			2011 – 12		
		Urambo	Tumbi	Chunya	Urambo	Tumbi	Chunya
1	K 326	3	2	2	3	4	2
2	DDV 10	1	1	1	1	1	1
3	DDV 23	1	1	1	1	1	1
4	DDV 42	1	1	1	1	1	1
5	DDV 43	1	1	1	1	1	1

Angular Leaf Spot (ALS) Assessment (scores of 1-5):
1 = No symptoms
2 = Faint chlorosis (can define point of inoculation)
3 = Distinct chlorotic spots
4 = Tiny lesions (ALS just starting)
5 = Extensive necrosis (typical ALS)

Table 6: Assessment of Alternaria Infection

No	Variety	2010 – 11			2011 – 12		
		Urambo	Tumbi	Chunya	Urambo	Tumbi	Chunya
1	K 326	3	2	2	4	3	2
2	DDV 10	0	0	0	0	0	0
3	DDV 23	0	0	0	0	0	0
4	DDV 42	0	0	0	0	0	0
5	DDV 43	0	0	0	0	0	0

Alternaria Assessment (scores of 0 – 7):
0 = Nil
1 = Trace
2 = Slight
3 = Light
4 = Moderate

5 = Fairly severe
6 = Severe
7 = Very severe

Compared with the control K 326, the four DDV varieties had resistance to alternaria, angular leaf spot, and the root knot nematode but were all susceptible to frogeye.

ON-FARM ASSESSMENT REPORT

Introduction:

To ensure that technologies released address end users' needs farmers must be involved in technology development and evaluation/assessment. Farmers' participation in the evaluation will ensure faster awareness, acceptance and adoption of the released technologies. Farmers use their own Indigenous Knowledge and criteria to assess technologies and in most cases their criteria are not the same as the researchers' criteria. For any variety/technology acceptance or rejection it is their criteria, which is used to assess it at the end of the season. It is therefore very important to know farmers criteria in order to develop technologies, which will meet their needs and also be adopted faster by them.

Based on the abovementioned reasons some Farmer Managed Farmer Implemented (FMFI) trials were conducted to assess the performance of elite varieties in their own environments and socio-economic circumstances in order to determine their criteria for preference as well as preferred varieties.

Objectives

The specific objectives are:

1. To introduce and evaluate potential DDV tobacco varieties under farmers' conditions
2. To ensure participation of small /medium scale tobacco growing farmers in the evaluation of different DDV tobacco varieties under their own management and socio-economic circumstances
3. To understand farmers' criteria for preference of DDV tobacco varieties
4. To identify DDV tobacco varieties preferred by farmers
5. To provide feedback to variety development agents, leaf technicians and primary societies on the quality and performance of the tested tobacco varieties.
6. To increase tobacco production and quality to not only growers but also to customers preferences.

Methodology

The Tobacco Research Institute of Tanzania (TORITA) in collaboration with extension staff and farmers in Chunya, District in the Southern highlands conducted on-farm trials to assess four (4) new DDV tobacco varieties namely DDV 10, DDV 23, DDV 42 and DDV 43 (formerly coded DDV 10, DDV 33, DDV 26 and DDV 13 respectively) compared to K 326 as the control variety. The criteria for farmers' selection to participate in the evaluation were land availability, accessibility to the sites, farmers' interest to participate in the trial and the willingness to welcome other farmers to the field to learn and share experiences about the varieties.

The spacing used was 120 cm x 50 cm. The trial was Farmer Managed Farmer Implemented. Data collected was number of plants survived, number of leaves reaped per plant, leaf body, size and texture at field, cured leaf colour and yield per area. An ANOVA was performed for the data collected and a Duncan Multiple Range Test (DMRT) was used to separate the means. Farmers' assessment was done using absolute, matrix and pair wise rankings. Farmers' assessment report and yield potential data are presented in the report

RESULTS AND DISCUSSION

Farmers' assessment session was conducted at Mtanila village Chunya District on the 9April, 2014. The session was attended by a total of fifty eight (58) farmers and two (2) leaf technicians (35 males & 23 Females). The farmers who participated had direct exposure to see them through the on-farm trials and also with long time-experience and skills in assessing tobacco varieties performances. Farmers were first asked to observe the varieties in the field before assessing them. The varieties were evaluated using absolute, matrix and pair wise rankings.

Factors considered to the introduction of the new tobacco varieties:

Farmers were asked as what are the main factors to be considered on the introduction of these new varieties in this country. Table 1 summarizes the factors mentioned by these farmers,

Table 1: Main factors prioritized by the tobacco growers of Southern highlands of Tanzania

No	Factors considered	Rank
1	High yield	**2**
2	Cured leaf (colour)	**1**
3	Ripening rate	**3**
4	Disease tolerance	**5**
5	Leaf body	**6**
6	Number of days on curing	**4**
7	Stems to lamina ratio	**8**
8	Drought tolerance	**7**

Cured leaf:

Mainly involve the colour if it is orange, rich lemon or lemon but also it is associated with either bodied leaf or thin and texture if it is oily or brittle.

High-yielding

The yield per acre/hectare also was the second factor considered by these farmers

The varieties establishes well from beginning such that deaths were less such that Crop looks very uniform and makes easy on reaping by its position

Tolerance to diseases

The Rootknot nematode *M. javanica* is a major problem in Tanzania; compared with the susceptible control K 326, the DDV varieties are resistant to the pest.

Ripening rate

Farmers were interested in slow ripening varieties that will give them time to cure it properly. Fast ripening varieties result in over packing of barns and significant loss of leaf.

Less days on curing

Very few farmers who have enough curing capacity, therefore they were much eager to see how many days will take to cure the leaf in a barn (turn round)

Lamina stem ratio

Customers do like varieties with more lamina percentage than big stem/ midribs.

Leaf size & body

Farmers were interested to see the broad, bodied leaves that they believe will give back more money rather than thin bodied and narrow tobacco leaves.

Drought resistance

With prolonged drought farmers prefer varieties that are more tolerant of drought.

Absolute ranking:

The absolute ranking of the DDV tobacco varieties is shown in Table 2.

Table 2: Absolute ranking of DDV tobacco varieties in Southern highlands Tanzania in 2014

No	DDV tobacco varieties	Rank
1	DDV 10	1
2	DDV 43	4
3	DDV 42	2
4	DDV 23	3
5	K 326	5

DDV 10, ranked number one followed by DDV 42, DDV 23 and DDV 43 that ranked third and fourth (last) respectively

DDV tobacco varieties characteristics

Farmers listed the characteristics of each DDV tobacco variety as observed in the field using experience they have as indicated below in Table 3

Table 3: Farmers' description of the evaluated DDV tobacco varieties

DDV 10 • Slow maturity compared to K 326 • Drought tolerant • High yield • Broad leaf • Mottled leaf • Resistant to alternaria and angular leaf spot • It has better lamina to stem ratio • Medium plant height • It has rich lemon cured leaf • Resistant to rootknot Nematodes	**DDV 42** • Slightly taller than K 326 • Slower ripening compared to K326 • Fairly drought tolerant • It is not brittle • Very broad leaf • Strong stalk • Mottled leaf • Resistant to alternaria and angular leaf spot • Rich lemon to orange cured leaf • Resistant to rootknot nematodes
DDV 43 • Slow ripening • It is a medium to tall plant • Fairly drought tolerant • High yielding • Lemon to deep lemon in colour • Mottled leaf • It has higher lamina percentage • Strong stem • Resistant to alternaria and angular leaf spot • Resistant to rootnot nematodes	**DDV 23** • Medium height plant • Slow ripening • Average drought tolerant • It has better expansion leaf • High yielding • Srong stalk • Rich lemon leaves • Cures easily • Less breakages • Resistant to rootnot nematodes

Criteria used by farmers to select DDV tobacco varieties

Farmers mentioned the criteria they use to select DDV tobacco varieties as shown in Table .**Table 4:**

Farmers' criteria in selection of DDV tobacco variety in Southern highlands Zone in 2014

No	Criteria	Rank
1	High yield	2
2	Cured leaf (colour)	1
3	Ripening rate	3
4	Disease tolerance	5
5	Leaf body & expansion	6
6	Number of days in curing	4

7	Drought tolerance	7
8	Lamina stem ratio	8

The most important farmers' criteria for DDV tobacco variety preference were colour to a cured leaf, ripening rate/interval, high yield, leaf expansion, lamina stem ratio, strong stalk/plant height, disease tolerance, and drought tolerance.

The 8 criterion were used in the next step of matrix ranking where these criterions were scored for each varieties tested.

Matrix ranking

Farmers conducted a matrix ranking of the four DDV tobacco varieties using these most important criteria as indicated in Table 5.

Table 5: Matrix ranking of DDV tobacco varieties in Southern highlands Tanzania in 2014

No	**Criteria**	**Tobacco varieties**					**Total**	**Rank**
		DDV 10	**DDV 23**	**DDV 42**	**DDV 43**	**K 326**		
1	Drought tolerance	3	2	2	3	2	**12**	**6**
2	Ripening rate	5	5	4	3	3	**20**	**2**
3	High yield	5	3	4	5	3	**20**	**2**
4	Cured leaf (colour)	5	4	5	4	3	**21**	**1**
5	Leaf body & expansion	4	3	3	3	3	**16**	**5**
6	Number of days in curing	4	2	3	5	3	**17**	**3**
7	Lamina stem ratio	3	5	4	3	2	**17**	**3**
8	Disease tolerance	3	3	3	5	2	**16**	**4**
Total		**32**	**27**	**30**	**31**	**21**	**28**	
Rank		**1**	**4**	**3**	**2**	**5**		

Key for scores: 1 = Poor, 2 = Satisfactory, 3 = Average, 4 = Good and 5 = Excellent

Variety DDV 10 ranked "excellent" on ripening rate, high yield, and leaf colour. DDV 43 scored "excellent" on high yielding, number of days on curing and disease tolerance. DDV 42 had an "excellent" ranking in cured leaf. While DDV 23 scored "excellent" on ripening rate and lamina stem ratio. Across all criteria DDV 10 ranked as 1 and DDV 43 ranked number 2 and followed by DDV 42 and last DDV 23 in matrix and pair wise ranking. Based on the criteria used, DDV 10 andDDV 43 were the most preferred variety followed by DDV 42 and DDV 23 respectively.

Pair wise ranking

Farmers did a pair wise ranking as shown in Table 6.

Table 6: Pair wise ranking of DDV tobacco varieties in Southern highlands, 2014

	DDV 10	**DDV 42**	**DDV 43**	**DDV 23**	**K 326**	**Total**	**Rank**
DDV 10	**Xxxxx**	DDV 10	DDV 10	DDV 10	DDV 10	**4**	**1**
DDV 43		**xxxx**	DDV 43	DDV 43	DDV 43	**3**	**2**
DDV 42			**xxx**	DDV 42	DDV 42	**2**	**3**

DDV 23				**Xx**	DDV 23	**1**	**4**
K 326					x	**0**	**5**

In pair wise ranking, DDV 10 ranked number one as was the case in matrix rankings, followed by DDV 43 as second in both pair wise and absolute ranking. DDV 42 was ranked third in pair wise and in matrix. DDV 23 was ranked fourth and last in both pair wise and matrix rankings. This indicates that varieties DDV 10 and DDV 43 have the most preferred criteria by farmers compared to their commercial checks.

GRADES & YIELDS ANALYSIS:

The leaf yield varieties were significantly (P=0.05) higher than the checks. There were no significant differences (P=0.05) in leaf yields between the four varieties. However, DDV 43 yielded higher (2053Kg/ha) followed by DDV 10 (2015Kg/Ha.)

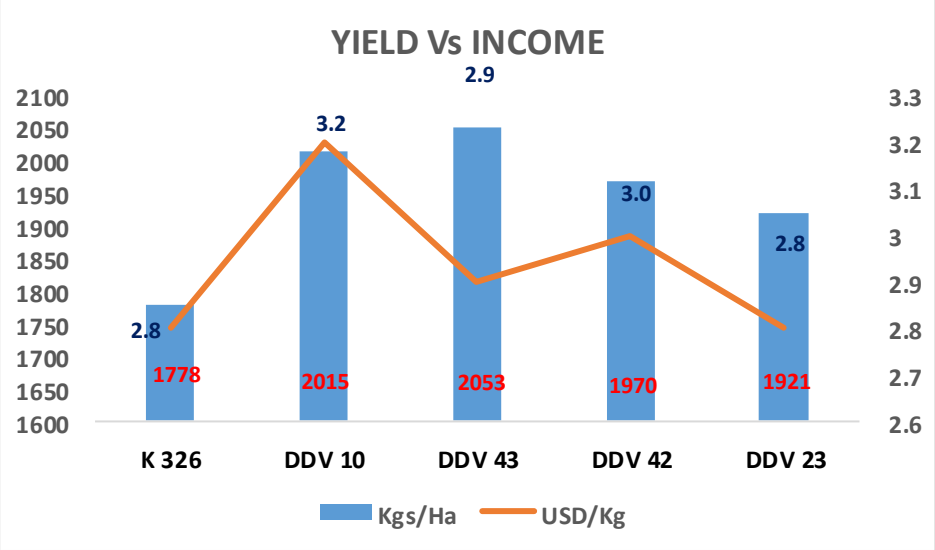


Figure 1: Yield data (kg/ha) for DDVs and K 326 Check

DDV 43 produced higher but less in price while DDV 10 produced a lower saleable yield compared to DDV 43 but higher in price. In general DDV 43 and DDV 10 are good in yield compared to DDV 23 and DDV 42; compared with all the DDV varieties, the control/check K 326 is less.

In terms of price DDV 10 and DDV 42 achieved higher prices compared to DDV 43, DDV 23 and the check K 326 respectively.

Most undesired characteristics:

The farmers' most undesired characteristics for tobacco varieties are shown in Table 7.

Table 7: Farmers' most undesired characteristics when selecting tobacco varieties in Southern highlands tobacco growers of Tanzania 2014 crop season.

No	Disliked characters	Rank

1	Very low yielding (thin bodied leaf)	2
2	Light lemon colour of the leaf (low quality)	1
3	Very slow ripening crop	5
4	Not drought tolerant variety	6
5	Very susceptible to diseases such rootknot nematodes	3
6	Very tall plant height	4
7	Very susceptible to lodging	7

Farmers do not like a variety that is light lemon in colour, low yielding/thin bodied leaf, tall variety difficult in harvesting, slow in ripening (it takes long time to finish curing), non-drought tolerance variety, and susceptible to lodging varieties as mentioned above.

Farmers' comments/suggestions/requests:

Lastly, farmers were asked to give their comments/suggestions/request. Below in Table 8 were such findings.

Table 8: Comment/suggestions/request

No	Comments/suggestions/requests	Rank
1	Nursery & field inputs should be in place before rain on set	1
2	Farmers to get frequent seminars/training	3
3	Tobacco seeds should be distributed on time to transplant earlier	4
4	Any new variety to be introduced they should be informed/involved	2

Farmers urged nursery and field inputs to be supplied before rain on set and once the new variety needs to be introduced they should participate on its evaluation. Others were frequent trainings/seminars and seeds distribution should be based on altitude of a particular area i.e. mid altitude or high altitude etc.

Conclusion

- Farmers' most important criteria for tobacco variety preference were leaf colour, ripening rate, high yield and tolerance to pests/diseases. Others were lamina stem ratio, leaf expansion and drought tolerance.

- The most preferred characteristics in all varieties were leaf colour, ripening rate, high yielding, rootknot resistance and leaf expansion.

- In terms of the absolute, matrix and pair wise ranking the varieties were preferred in the following order; DDV 10, DDV 43, DDV 42 and DDV 23 respectively.

- The least preferred variety was DDV 23.

As **DDV 10, DDV 43, DDV 42 and DDV 23** were mostly preferred varieties by the farmers in all the rankings, and also had the highest grades as well as yields, it is therefore strongly

recommended to be considered for release if they meet other requirements inclusive of DUS and agronomic performances.

NATIONAL PERFORMANCE TRIAL (NPT)

Introduction

TORITA applied for NPT for the confirmation of four (4) flue-cured hybrid tobacco candidate varieties DDV 10, DDV 23, DDV 42 and DDV 43. The major merits of these varieties areresistance to the root-knot nematode *Meloidogyne incognita/javanica,* alternaria and angular leaf spot, higher lamina percentages, higher leaf potentials, and slow ripening of leaves compared with the control K 326.

Materials and Methods

The trial was planted at three (3) locations,Urambo, Tumbi-Tabora and Chunya. The candidate varieties DDV 10, DDV 23, DDV 42 and DDV 43were compared with K 326 that is commonly grown by tobacco growers. The experimental design used was randomized complete block design with four replications. The plot size was 2.4 m x 17 m with double row plots. Seedlings were transplanted on a ridge at 50 cm interplant spacing. Data collected included dry leaf weight (kg/ha), lamina/midrib ratio (%), root-knot nematode, alternaria, frogeye and tobacco mosaic virus (TMV) scores.

Results and discussion

K 326 is an inherently narrow leaf number variety and when compared with the DDV varieties, had less leaf expansion specifically in the upper stalk as indicated by the difference in lamina percentage (table 1). In addition, the DDV varieties recorded significantly higher leaf potentials compared with the control. Therefore making them less prone to early flowering in adverse growing conditions. In terms of the saleable yields recorded, these were not a true reflection of the yield potential of the DDV varieties; delayed topping of the higher leaf potential DDV entries resulted in their being thin bodied and faster ripening than is normal. K 326, by comparison, is an early flowering variety, a characteristic that forced the topping of the variety. The advantage of high leaf potential is only realised when the variety is topped early at the recommended leaf number of 18 -19 leaves. The slightly disappointing grade indices recorded were a further indication of slightly more perished grades than expected of the DDV; this is indicative of a combination of delayed topping and reaping.

Conclusion

In general, when compared with K 326, the improved disease resistance and desirable characteristics (inclusive of slower ripening rate and better leaf expansion) of DDV 10, DDV 23, DDV 42 and DDV 43 are an indication that these four varieties will benefit growers in terms of both management and return per hectare

Table 3: Lamina Percentage 2013/14 season

Variety	2013 – 14		
	Urambo	**Tumbi**	**Chunya**
K 326	72.8b	68.5c	73.79c
DDV 10	74.77ab	72.13b	75.93abc
DDV 42	77.12a	73.64ab	76.86ab
DDV 23	75.63ab	74.88a	77.25a
DDV 43	75.11ab	72.44b	74.65bc
Mean	**75.1**	**72.32**	**75.7**
CV (%)	**5.24**	**2.02**	**1.94**
LSD	**5.83**	**2.25**	**2.26**

Table 4: Saleable Yield (kg/ha) 2013/14 season

No	Variety	2013 – 14		
		Urambo	Tumbi	Chunya
1	K 326	2551.14a	2285.28ab	1777.99b
2	DDV 10	2483.85a	2343.89ab	2015.355ab
3	DDV 23	2545.03a	2276.8b	1969.96ab
4	DDV 42	2345.71a	2009.46c	1921.09ab
5	DDV 43	2250.13a	2521.43a	2053.06a
	Mean	2435.17	2287.37	1937.48
	Lsd	284.6	200.37	208.01
	cv%	7.5	5.68	7.71

Table 5: Grade index for the 2010 -11, 2011 – 12 and 2013 – 14 seasons for Urambo, Tabora and Chunya districts

No	Variety	2010 - 11			2011 - 12			2013 – 14		
		Urambo	**Tumbi**	**Chunya**	**Urambo**	**Tumbi**	**Chunya**	**Urambo**	**Tumbi**	**Chunya**
1	K 326	1.03bc	0.93b	1.55a	2.17a	1.053ab	1.975c	2.06ab	3.069ab	2.79b
2	DDV 10	1.45b	1.25ab	1.63a	2.10ab	0.692c	2.16ab	2.21a	3.174a	3.2a
3	DDV 23	0.96c	1.32a	1.65a	2.08bc	1.067a	2.12abc	2.188a	3.069ab	2.87b
4	DDV 42	1.56ab	1.115ab	1.59a	1.98d	1.066a	2.02bc	2.166ab	3.00b	3.04ab
5	DDV 43	1.93a	1.21ab	1.65a	2.00cd	0.997b	2.02bc	2.21a	3.037ab	2.764b
	Mean	**1.66**	**1.165**	**1.618**	**2.07**	**0.975**	**2.1**	**2.16**	**3.08**	**2.93**
	lsd	**0.08**	**0.06**	**0.098**	**0.08**	**0.045**	**0.15**	**0.11**	**0.16**	**0.25**
	cv%	**3.24**	**3.76**	**3.98**	**2.59**	**2.63**	**4.76**	**3.36**	**3.37**	**4.16**

ANNEX;

Table 1: Leaf Potential and Recommended Topping Heights of Trial Entries

Cultivar	Leaf potential (No. of leaves)	Topping potential (No. of leaves)
DDV 10	>30	18 – 19
DDV 23	>35	18 – 19
DDV 42	>30	18 – 19
DDV 43	>30	18 – 19
K 326	23	17 – 18

Table 2: Summary of Diseases and Ripening Characteristics of the four varieties

Entry	Source	Ripening	Disease						
			RK	ALT	GW	BS	ALS & WF (1)	TMV	FROGEYE
K 326	Control	Fast			√				
DDV10	DDV	Medium - slow	√√√	√√	√	R	R	R	S
DDV23	DDV	Medium –	√√	√√√	√	R	R		S

		slow							
DDV42	DDV	Medium – slow	√√√	√√		R	R	R	S
DDV43	DDV	Medium – slow	√√	√√		R	R	R	S

KEY:
DDV denotes DDV Seed Services, Zambia
RK denotes rootknot nematode *Meloidogyne javanica*
ALT denotes alternaria
GW denotes Granville wilt
BS denotes black shank
TMV denotes tobacco mosaic virus
ALS denotes angular leaf spot
WF (1) denotes wildfire (race 1)
√ denotes level of resistance
R denotes resistant
S denotes susceptible
K 326 is a control